★ THE FOUNDRYMEN'S OWN MAGAZINE

American Foundryman

AUGUST
1948

HERE'S HOW...

CHICAGO TRANSIT AUTHORITY CUTS MELTING TIME IN HALF

. . . cuts fuel cost 50% . . . cuts metal losses 40%

Chicago Transit Authority, one of the world's largest transportation systems, operating 2,400 streetcars, 1,625 elevated cars, and 1,100 buses, installed a Fisher oil fired Simplex Melting Furnace for remelting, reclaiming scrap, brass, and bronze. Journal and axle bearing brasses and worn parts from all types of rolling stock are melted down and recast into new parts.

The new Fisher Simplex replaces a conventional oil fired spherical type open flame furnace. Check this "Before and After" story of faster melting, lower fuel cost, and lower metal losses.

	BEFORE	AFTER
Heating time 1000 lb. charge	2½ hrs.	1 hr.
Fuel cost per pound melted	$.0056	$.0027
Metal Loss	5%	3%

Ask for bulletin #28-A "Fisher Simplex Furnaces."

FISHER ADVANTAGES

Furnace charges *easily* from front at convenient height. . . . More metal can be charged as bath occupies but a *fraction* of melting chamber . . . Uses open flame reverberatory melting, the *fastest* fuel fired melting method . . . Two section furnace shell removable for *easy* relining.

Fisher Furnaces

A DIVISION OF LINDBERG ENGINEERING CO.

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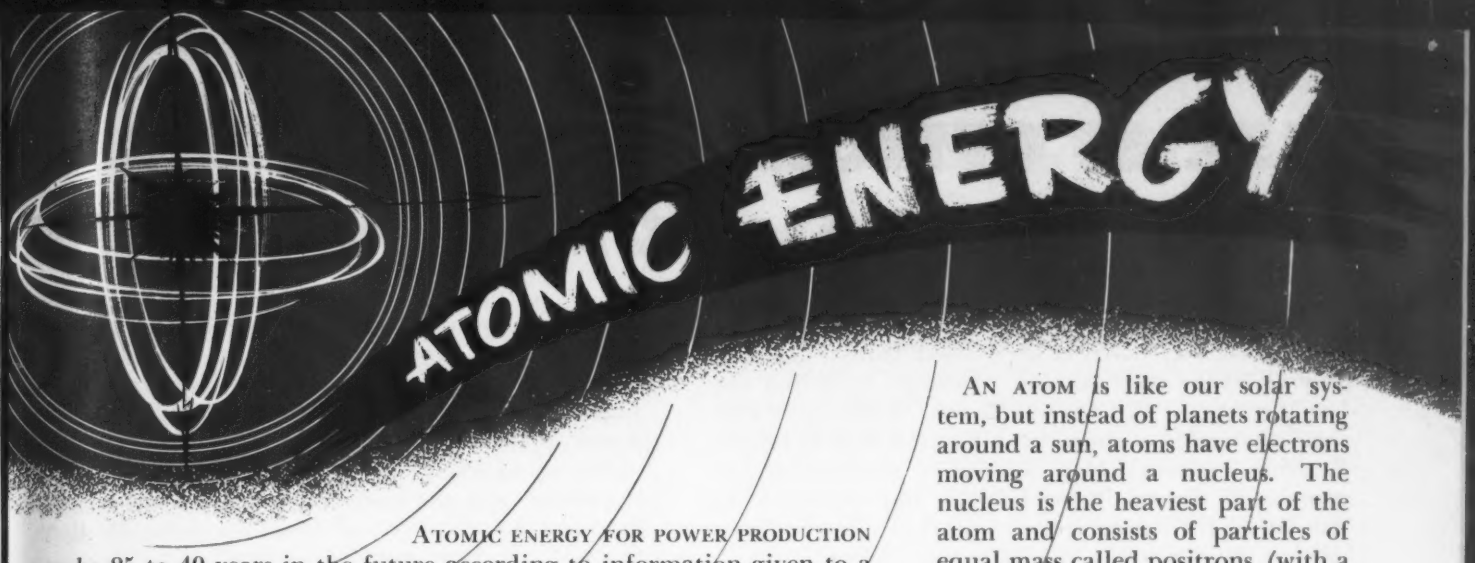


ATOMIC ENERGY FOR POWER PRODUCTION may be 25 to 40 years in the future according to information given to a small group of industrial editors who recently visited New York, Washington, D.C., and Oak Ridge, Tenn., at the invitation of the Atomic Energy Commission. Nevertheless, there is one known foundry application of atomic energy and valuable metallurgical research has made use of some of the by-products of atomic energy production.

Atomic energy power plants, automobiles and aircraft driven by a bit of small but potent atomic fuel, use of atomic energy for heating homes and offices, and other applications predicted by science fiction writers are not to be expected until basic materials problems have been solved.

Ordinary structural metals suffer severe radiation damage and bad losses in mechanical properties. One effect is an increase in hardness such as pure metals experience on the introduction of an impurity. Good turbine steels eventually go to pieces. Glass—important in the chemical separation of radioactive materials—becomes embrittled and fails.

Even if the materials problem were not a drawback, cost and heavy shielding to protect passengers make small atomic power plants for vehicles impractical. Most likely early application of atomic power is in large ships where cost is less important than efficiency and saving in fuel space.

Present known uses of atomic energy of interest to foundrymen involve the utilization of radio-isotopes. These are atoms made radioactive in a "pile"—equipment which is the forerunner of atomic energy plants. An atom can be made to give off radiation which enables it to be traced through a plant, animal, or human, or through an industrial process, while it carries on the chemical function normally attributed to it. Thus radioactive phosphorus, chemically the same as normal phosphorus, can be traced as it passes through the body until it becomes part of the bony structure. Not only the location, but the time required to get there can be determined.

Radioactive phosphorus, used in segregation studies in small castings, discloses its location by its effect on x-ray film placed against sections of the test casting. The use of about $150 worth of radioactive sulphur to follow this element in coal through a coke oven was reported in the May issue of AMERICAN FOUNDRYMAN, page 80. Diffusion of radioactive copper atoms through pure copper blocks during annealing provides interesting data on migration of atoms.

Other metallurgical applications of radio-isotopes include the determination of the location of carbon in hardened ferrous alloys, and the study of order-disorder phenomena. The mechanism of pearlite growth, grain growth, and copper oxidation are other examples.

Radioactive cobalt, like radium, can be used for non-destructive testing. It is being used in a direct foundry application to measure the depth of liquid metal in the well zone of a cupola. The test is based on the difference in absorption of radiation above and below the liquid iron level.

Temperature developed through fission of atomic nuclei presumably could be as great as that of the sun, estimated at 20,000 C. Will some foundryman someday develop atomic melting by mixing an appropriate number of fissionable atoms with the melting stock and starting a controlled chain reaction?

AN ATOM is like our solar system, but instead of planets rotating around a sun, atoms have electrons moving around a nucleus. The nucleus is the heaviest part of the atom and consists of particles of equal mass called positrons (with a positive electrical charge) and neutrons (with no charge). The electrons have a negative charge.

After experimenting with atom smashing for many years, scientists discovered in 1939 that neutrons travelling at the right speed would split the nuclei of certain atoms.

If a neutron strikes the nucleus of U-235 (uranium atom with a nucleus of 92 protons and 143 neutrons) splitting occurs and energy is released. Along with the atomic energy, two new atoms are produced, and neutrons are released.

The neutrons strike other atoms of U-235 and start a chain reaction which releases energy for power or for weapons depending on the rate at which the energy develops.

If a neutron strikes a U-238 nucleus (92 protons, 146 neutrons), it is absorbed and the weight of the atom increases from 238 to 239—then the atom changes first to neptunium, then to plutonium. Like U-235, plutonium will split if the nucleus is hit by a neutron; U-235 and plutonium are atomic fuels.

Neutrons traveling too fast will not split atoms nor be absorbed by the nucleus. To slow fast neutrons, scientists use several substances as moderators—chiefly graphite. A "pile" or nuclear reactor used for generating atomic power consists of graphite blocks (moderator), uranium metal rods (fuel), and steels rods (control). The steel rods can be moved in and out of the nuclear reactor to control the atom splitting or to stop it completely by absorbing the neutrons.

Uranium is only 0.7 per cent U-235 so it is necessary to separate these atoms from the U-238. The concentration is done by gaseous diffusion, by a magnetic process, and by liquid diffusion.

—H.F.S.

A. F. S. OFFICERS AND DIRECTORS HOLD ANNUAL BOARD MEETINGS

OFFICERS AND DIRECTORS of the American Foundrymen's Society gathered at the Palmer House, Chicago, July 29-30 for their Annual Meetings, including the last meeting of the 1947-48 Board of Directors and the first meeting of the newly organized 1948-49 Board. Retiring President Max Kuniansky presided at the meeting of the old Board July 29, and the following day W. B. Wallis accepted the gavel as the new President of the Society for the current fiscal year.

Reports of Officers and Committees covering activities during the fiscal year ended June 30, 1948, were presented at Thursday's meeting, enabling the old Board to review the year's activities and discharge its obligations to the membership. On Friday the new Board of Directors carefully studied the financial structure and practices of the Society with a view to establishing a more permanent financial policy, in the light of constantly increasing costs of servicing the ever-growing demands of a world-wide membership which thus far has shown no signs of reduction.

Closing dates having prevented publication of the complete story of these meetings in the current issue, full details of the important actions taken by the new Board July 30 will appear in the September issue of AMERICAN FOUNDRYMAN.

The official audit of the Society's financial records for the fiscal year ended June 30, 1948, as prepared by Lybrand, Ross Bros. & Montgomery of Chicago, was accepted by the retiring Board of Directors. Immediately following adjournment on July 29, the new Board organized the Executive Committee for 1948-49, consisting of President Wallis, Vice-President E. W. Horlebein, and the following elected members: Past President Kuniansky, and Directors John M. Robb, Jr., S. C. Wasson, and V. E. Zang.

At the opening of the new Board Meeting July 30, Secretary-Treasurer Wm. W. Maloney was re-elected for the current fiscal year. President Wallis then announced the appointment of Chairmen for the following standing and appointive committees:

Finance Committee—President Wallis, *Chairman;* Vice-President Horlebein; Director Robb; National Membership Committee—Vice-President Horlebein, *Chairman;* all Chapter Membership Chairmen as members; Chapter Contact Committee—Vice-President Horlebein, *Chairman;* Auditing Committee—Director Wasson, *Chairman;* By-Laws Committee—*Chairman,* H. Bornstein, Deere & Co., Moline, Ill.; Annual Lecture Committee—*Chairman,* G. Vennerholm, Ford Motor Co., Detroit; International Relations Committee—A.F.S. Secretary Maloney, *Chairman;* Publications Committee—(to be appointed).

Officers and directors of the American Foundrymen's Society at the Annual Meeting. Left to right: F. C. Riecks, Ford Motor Co.; H. H. Judson, Minneapolis-Moline Power Implement Co.; Robert Gregg, Reliance Regulator Corp.; J. E. Kolb, Caterpillar Tractor Co.; E. N. Delahunt, Warden King, Ltd.; J. M. Robb, Jr., Hickman, Williams & Co.; Vice-President E. W. Horlebein; T. H. Benners, Jr., T. H. Benners & Co.; President W. B. Wallis; Retiring President Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va.; Secretary-Treasurer Wm. W. Maloney; Technical Director S. C. Massari; Jas. H. Smith, General Motors Corp.; A. M. Fulton, Northern Malleable Iron Co.; W. J. McNeill, Dayton Malleable Iron Co.; B. L. Simpson, National Engineering Co.; F. M. Wittlinger, Texas Electric Steel Casting Co.; N. J. Dunbeck, Eastern Clay Products, Inc.; V. E. Zang, Unitcast Corp.; S. V. Wood, Minneapolis Electric Steel Castings Co.; S. C. Wasson, National Malleable & Steel Castings Co. Not present were H. G. Lamker, Wright Aeronautical Corp.; H. A. Deane, American Brake Shoe Co.; and A. C. Ziebell, Universal Foundry Co. Messrs. Judson, Smith, Wittlinger, and Wood are retiring as directors; new directors are Messrs. Benners, Fulton, Dunbeck, and Zang.

TECHNICAL COMMITTEES CONVENE

Gray Iron Committee

THE A.F.S. GRAY IRON EXECUTIVE COMMITTEE, under the chairmanship of R. G. McElwee, met at the Book-Cadillac hotel, Detroit, June 23, to report on activities of the various gray iron committees during the past year and to discuss plans for the coming year.

N. A. Birch, chairman of the Committee on Gating and Risering, stated that his Committee is currently undertaking a project to determine factors affecting the risering of gray iron castings, and added that the Committee intends to circulate a questionnaire on methods of gating and risering castings of specific design, the first of which will be a V-belt sheave having four spokes. Mr. Birch stated that his Committee is now working with the Research Committee to develop the detailed specifications of a research project.

Chairman J. S. Vanick reported that the Research Committee is proceeding with the solicitation of an organization to undertake the research on gating and risering. He recommended that a study of the effect of sulphur be undertaken by a newly-appointed committee to be headed by W. W. Levi, chief metallurgist, Lynchburg Foundry Co. The recommendation was accepted unanimously.

Reporting on the activities and future plans of the Program and Papers Committee, Chairman V. A Crosby stated that plans for the 1949 A.F.S. Foundry Congress in St. Louis include participation in a Symposium on Centrifugal Casting, to be held jointly by the A.F.S. and ASTM.

The Gray Iron Shop Courses will again be given, Mr. Vanick said, under the sponsorship of the Shop Course Subcommittee. At the Gray Iron Round Table Luncheon to be held for the first time in 1949, the subject of gating and risering will be discussed, and Lyle L. Clark has been appointed to head a subcommittee to prepare discussion plans.

Chairman R. G. McElwee, reporting for the Cupola Research Committee, cited progress being made on coke quality and behavior in the cupola, for the purpose of developing tests for pre-evaluating the behavior of coke. The Committee, he said, is also making a study of cupola slags to develop the best slagging practice and proper slag composition in order to achieve the most uniform and economical cupola operation.

Reactivation of the Chill Test Committee was approved, and it was suggested that J. L. Brooks of the Muskegon (Mich.) Piston Ring Co. be appointed chairman. It was also suggested that J. Buckman be added to the Committee.

In the absence of Chairman W. A. Hambley of the Analysis of Casting Defects Committee, A.F.S. Technical Director S. C. Massari reported publication of the ANALYSIS OF CASTINGS DEFECTS. The Executive Committee complimented the Committee on the excellent performance of its duties.

Chairman George A. Timmons, reported for the Committee on Heat Treatment of Cast Iron, with specific reference to the Symposium on Heat Treatment at the 52nd A.F.S. Foundry Congress. The Executive Committee approved continuation of efforts to obtain additional pertinent papers on heat treatment for presentation at the 1949 Convention or for publication in AMERICAN FOUNDRYMAN.

In the absence of H. W. Lownie, chairman of the Committee on Microstructure of Cast Iron, Technical Director Massari reported that the Committee had circulated a comprehensive questionnaire to a large number of foundries, laboratories and educational institutions as a means to determine the present status of methods of polishing micro samples of gray iron. Results are now being compiled.

R. W. Mason, chairman of the Committee on Section-Size Relationships, reported that the Committee is planning to prepare a report on its findings for presentation at the 1949 Foundry Congress.

Norman Birch, in the absence of Chairman R. A. Flinn, reported that the Committee on Test Bar Design has several test bars under consideration and that tests are being conducted by the Committee to establish the best methods of gating and risering to produce a sound bar which will reflect the true characteristics of the metal. Chairman McElwee suggested that Mr. Flinn be asked to combine in the same mold both a tensile and transverse test bar, since many castings are sold to transverse test specification only.

Claude Jeter, chairman of the Committee on Welding, advised that to his knowledge no new developments have taken place since the last papers were presented on this subject before the 1947 Convention. The Executive Committee advised that this Committee should continue its efforts and be on the lookout for new developments in welding, and to acquire such papers as are available.

In attendance at the meeting were:

Chairman R. G. McElwee, Vanadium Corp. of America; N. A. Birch, American Brake Shoe Co.; L. L. Clark, Buick Motor Co.; V. A. Crosby, Climax Molybdenum Co.; T. E. Eagan, Cooper-Bessemer Corp.; E. C. Jeter, Ford Motor Co.; W. E. Mahin, Armour Research Foundation; R. W. Mason, International Nickel Co.; G. A. Timmons. Climax Molybdenum Co.; J. S. Vanick, International Nickel Co.; and S. C. Massari, A.F.S. Technical Director.

Cupola Research Committee

THE A.F.S. CUPOLA RESEARCH COMMITTEE, meeting at the Book-Cadillac hotel, Detroit, June 23, discussed the results of current research projects on coke quality and its effects on cupola operation, and on proper slagging techniques.

In summarizing the results of research work being sponsored by the Committee, Chairman R. G. McElwee stated that four carloads of coke have been promised by the Ford Motor Co., through the efforts of the late R. H. McCarroll. Of these, Mr. McElwee said, a 16 and a 20-hour coke have already been shipped and run in the Vassar Foundry Division of the Eaton Mfg. Co., Vassar, Mich.

The 16-hour coke performed very poorly and operations were abandoned at the end of three hours. The 20-hour coke melted satisfactorily, but to date there is no basis for comparison with fuels of other manufacturing heredity, Mr. McElwee said. It is hoped that

the next carloads will be 24-hour and 48-hour coke, he added.

Samples of the cokes tested were sent to the U. S. Bureau of Mines, the Canadian Bureau of Mines and the Gray Iron Research Institute—all three of whom expressed dissatisfaction with the coke because it had not been made with the same coal mixtures. The 20-hour was cited as containing 20 per cent anthracite, not used in a normal blend of coals. In reply, E. C. Jeter stated that this mixture had been used for some time, due to the greater availability of anthracite, and had met with reasonably good success in the cupola.

In reviewing the tests run on this coke at the Vassar Foundry, T. Giszczak, A.F.S. Research Metallurgist, stated that the 20-hour coke disintegrated considerably in handling or due to weathering. The 16-hour coke produced difficulty with increased blast pressures and lower melting temperature. Carbon pickup on both cokes appeared to be satisfactory. It was necessary to abandon the 16-hour coke because of the extreme blast pressures and the other coke was used for the balance of the day's heat, Mr. Giszczak said.

A. E. Schuh advised that the Gray Iron Research Institute will run test heats on both cokes and will report results obtained. Dr. R. L. Brown of the U. S. Bureau of Mines, presented a letter on the results of Bureau tests from the supervising chemist of the Coal Carbonization Section, which said:

"I would say that the shatter test is not too bad, although our results place the two cokes in reverse order from that reported.

"The tumbler test in both cases is very low—indicating friable coke. We have found this to be characteristic of the anthracite blends. I would not expect 5 per cent anthracite to drop the tumbler tests so low—possibly the two coals used in the blend are not too good," the letter concluded.

J. E. Rehder of the Canadian Bureau of Mines reported that the Bureau is in the process of conducting electrical conductivity tests on both samples of coke, and that results would be available very shortly.

A. L. Boeghold emphasized the need for additional new laboratory tests to pre-evaluate coke quality for cupola use, and expressed the hope that both the Canadian and United States Bureaus of Mines would find it possible to undertake this type of research as their contribution to the project.

C. F. Joseph outlined experiments being co-operatively conducted with the Canadian Bureau of Mines involving three ABC cokes of low carbon pickup, high carbon pickup and normal pickup characteristics. Samples will be tested by the conductivity method.

It was the consensus of the Committee that oxygen cannot be used at present for continuous cupola operation for economic reasons, unless the cost of coke increases or the price of oxygen is lowered.

During the course of discussion on cupola operations by Mr. Giszczak, it became apparent that proper slagging technique is closely related to carbon pickup from the coke and that the burnout of refractories in the fusion zone of the cupola is also closely related to slag composition and technique. Work is rapidly progressing in the accumulation of supporting data, Mr. Giszczak said. He requested that study be given to slag volume and its relation to cupola operation.

The entire roster of Committee members attended the meeting. Those present were:

Chairman R. G. McElwee, Vanadium Corp of America; Vice Chairman A. E. Schuh, U. S. Pipe & Foundry Co.; A. L. Boeghold, General Motors Corp.; H. Bornstein, Deere & Co.; E. C. Jeter, Ford Motor Co.; C. F. Joseph, General Motors Corp.; J. E. Rehder, Canadian Bureau of Mines; E. H. Stilwill, Chrysler Corp.; J. S. Vanick, International Nickel Co.; A.F.S. Technical Director S. C. Massari; R. L. Brown, U. S. Bureau of Mines; and T. Giszczak, A.F.S. Research Metallurgist.

Elevated Temperatures Committee

A TWO-DAY MEETING, comprising foundry work and technical sessions, was held June 14 and 15 at the University of Michigan by the Committee on Physical Properties of Iron Foundry Molding Materials at Elevated Temperatures.

The technical sessions were devoted to review and approval of the final report on *Causes of Rat-Tail Casting Defect,* which is now ready for publication.

The consensus was that the procedure for the new program on the study of scab be similar to that used in rat-tail research, except that two castings be made for each sand mixture.

In the foundry work, two patterns were used—one a flat piece $1\frac{5}{16}$ in. thick, and the other an angle casting. The angle pattern was selected because it has a greater variety of surfaces. Six different sand mixtures were used, two of which gave castings without scabs. Two scabbed in the corner of the drag surface, and two gave many scabs on all surfaces except the cope. It appears that satisfactory scabbing sand has been devised that can be used as a standard or reference mixture to study scabbing variables. A series of tests was run on the effect of pouring temperature on sand.

The room temperature sand tests are being made at the American Brake Shoe Laboratories, and the elevated temperature tests at the laboratories of the Harry W. Dietert Co.

New York To Adopt A.F.S. Training Outline As Basis For Manual Series

THE A.F.S. OUTLINE FOR APPRENTICE TRAINING, now in preparation, will be used by the New York State Education Department as the basis for a series of foundry instruction manuals.

Eugene D. Fink, chief of the Education Department's Bureau of Vocational Curriculum Development and Industrial Teacher Training, and Harold Hershey, instructor in foundry practice at the Paul Revere Trade School, Rochester, and member of the A.F.S. Rochester Chapter, are collaborating in the preparation of the first year manual, which will eventually be followed by second, third, and fourth year manuals for the guidance of foundry apprentices and students.

The first manual, expected to be published within the next few months, will consist of 72 two-hour lessons in foundry practice.

The OUTLINE FOR APPRENTICE TRAINING, was developed by the A.F.S. Apprentice Training Committee, headed by Professor William H. Ruten of the Polytechnic Institute of Brooklyn.

Questions THE ROUND TABLE Answers

How Long Does It Take to Train a Foundry Apprentice?

LEADERS IN TRAINING AND EDUCATION have given considerable attention to methods used during the war for rapidly training service men and war workers. The usefulness of short term training methods for foundry workers has been mentioned at A.F.S. meetings and discussed in the literature —most recently by J. G. Goldie, M.B.M. Foundry, Inc., Cleveland, whose *"Apprentice Training or Short Term Training?"* appears in the June issue of AMERICAN FOUNDRYMAN.

Because of the shortage of skilled men in the foundry industry today—a shortage due to current high employment in all industry and to past failure to interest and train young men in foundry work—it has been suggested that the term of foundry apprenticeship be shortened. Wondering whether apprentices can be trained by short term methods, AMERICAN FOUNDRYMAN asked foundry industry educational leaders: **"How long does it take to train a foundry apprentice?"**

Answers to this question are given below.

Henry Louette, *a member of the A.F.S. Apprentice Training Committee and long interested in foundry education and training problems, is plant superintendent of Warden King Ltd., Montreal, Quebec. Born in Belgium, he moved to Canada where he studied at the Montreal Technical School, graduating in 1918. He started at Warden King in 1921.*

How long does it take to train a foundry apprentice?—a minimum of four years.

There may be exceptional cases where special aptitude or educational background plays a part in reducing the normal time for apprenticeship but for the average young man I believe four years are essential. The wartime reduced training period I think can best be explained in the term "training for *special* skills" and does not indicate that the trainee covered the entire field of endeavor with the same thoroughness that we assume in apprentice training. When we speak of a foundry apprentice we do not refer to apprentice molder, apprentice core maker, etc., but one who at the completion of the prescribed training period can be placed successfully in any department which is an integral part of the foundry.

Dean C. J. Freund *of the college of engineering, University of Detroit, is a member of the A.F.S. Education Division's Advisory Group and for a number of years was a member of the Apprentice Training Committee. A graduate of Campion College and Marquette University, he worked at Falk Corporation and Milwaukee Vocational School.*

The more I think about the question of industrial training, and of foundry apprenticeship in particular, the more convinced I become that an abitrary apprenticeship, of four or five or any other number of years, is not the right answer. I should like to suggest that the problem be approached experimentally, in the manner which has proved so successful in many other fields. It seems to me that the necessary steps to determine the proper length of apprenticeship in any craft or trade are as follows:

1—A thorough and quantitative investigation or job analysis to determine in detail the precise skills and competences which the trade in question requires of the fully qualified mechanic.

2—A research under actual operating condition to determine the length of time required by the average young man to acquire each of these special and essential skills under normal shop conditions and adequate supervision.

3—Construction of a schedule of apprenticeship based upon the investigations completed.

Heretofore apprenticeship standards have been determined largely upon the basis of the joint opinion of experienced people in the field, none of whom, however, had any basis for their opinion except casual experience and observation, and tradition.

The procedure suggested would require considerable work, but it might show that there has been a great deal of waste time and that the saving would justify the effort.

J. E. Goss, *industrial activities administrator for Brown & Sharpe Mfg. Co., Providence, R.I., has been with his company for 30 years. His early experience includes seven years as a draftsman for industrial firms and five years as a high school instructor. A veteran member of the A.F.S. Apprentice Training Committee, he is an authority on the subject.*

Our apprenticeship time for molding is three years; for wood patternmaking, four years; for metal patternmaking, three years. Since these are our terms, it is obvious that we feel that they are necessary to the fulfillment of our agreement with an apprentice to thoroughly teach him his chosen trade.

For many years there has been a tendency toward concentration of the learning of the techniques of a trade, but in such cases little consideration seems to have been given to the value of reasonable amounts of repetitive work, in order to assure not only the learning but also the remembering of these techniques. Moreover, there is great value in learning to apply techniques to a variety of work.

We must not allow "progress in the field of education" to lead us too far away from the fundamentals on which apprenticeship is based.

Burt L. Bevis *graduated from the training department of Caterpillar Tractor Co., Peoria, Ill., in 1941 and is now foundry training supervisor. When not coaching apprentices to win first prizes in the A.F.S. Annual Apprentice Contest, he studies at Bradley University. He is a member of the Apprentice Training Committee of the Society.*

In my opinion we should be concentrating on how to do a better job of training in four years rather than how we can accelerate training to a shorter period. That is, of course, if we are training good all-around foundrymen who know each department in a modern foundry, rather than specialists at any one phase of the foundry trade. Four years to fully understand a business that has been growing as rapidly as the foundry is barely time to give the essentials of the trade.

As for "the experiences of the military services," I have firsthand information on that, and from the "receiving end." Such "shotgun" courses, as we called them, were never too successful. The instructions were hurried, and often important information was glossed over because of the limited time. To teach effectively the learner must enjoy and take part in discussions and assignments. How many men in the services retained the knowledge they learned at these service schools? Very few, in my opinion, and among my acquaintances, almost none of them elected to continue the same work in civilian life.

Rather than shorten the present term of apprenticeship, let us continue to make better use of the four-year course we now have by the full use of visual aids, sound movies, illustrations and lectures.

S. M. Brah *has had experience with the apprentice training system as an apprentice, as an apprentice supervisor for the Tri-City Manufacturers Association, and as industrial co-ordinator for International Correspondence Schools. He is at present supervisor of personal relations for Armco's Rustless Iron and Steel Division of Baltimore, Md.*

The best answer that immediately comes to my mind upon reading the question "How long does it take to train a foundry apprentice?" is—as long as necessary! This question is very much like the one "How high is up?" It is obvious that the objectives of each foundry will control the scope of training on the one hand, and the qualifications of the candidate for apprenticeship will determine the rate of ability to assimilate the knowledge required to qualify as a foundryman. We need not be too much concerned as to whether the period is two, three, four, or five years. Rather our emphasis should be on the careful planning of the training program, careful selection of the prospective apprentices, and close supervision and administration of the training period.

Twenty-five years ago Horace Frommelt, then handling the training activities for the Falk Corporation in Milwaukee, had two distinct programs—one for college graduates which was of two-year duration, and the other for high school graduates or an equivalent background with a four-year duration. Therefore, we do have experience in variable periods of training time for foundry apprentices.

A great deal of misunderstanding exists in the minds of all classes of people as to what constitutes a foundryman. If we are all thinking alike that a foundryman is one who is a master craftsman—capable of performing all operations of the foundry industry from the calculation of charges for the cupola to the patching, relining, and operation; of producing quality castings from any type of mold and applying the job to the proper machine or equipment for the molding thereof from the standpoint of best economy; has a knowledge of gating and all the other techniques including sand

control, etc.—it is obvious that four years is not too long a period of time. If, however, we are trying to make a squeezer operator or a jolt roll-over operator (and I use the word *operator* advisedly because in many production foundries this class of employee is not able to pass judgment on the condition of the sand and would not know where to put the chaplets unless someone told him) then a short period of training from a week to three months is sufficient. This class of employee should never be considered apprentices but rather trainees. Further, irrespective of whether we are training apprentices or what I have referred to as foundry operators, the techniques of JIT* are applicable in both situations and are just good common sense.

William H. Ruten, *associate professor of industrial practice, Polytechnic Institute of Brooklyn, is chairman of the Apprentice Training Committee. Author of two books and a number of articles, he worked as a patternmaker after completing his apprenticeship and later received B.S. and M.A. degrees from the University of Michigan.*

The number of years required to train a foundryman depends upon the degree of skill sought. Small skills can be acquired in a short time; greater skills take longer. There is nothing mysterious or sacred about the length of the regular four year apprentice training period. Each foundry can well determine for itself the length of time necessary to be devoted to apprentice training. When the men who are under the training program have acquired the necessary all around skill, then the training period might end.

Criticism is frequently voiced against the regular four year apprentice training program on the grounds that there is some waste of time that might be eliminated. The apprentice training period can be viewed as a growing up period for younger men, or as an adaptation period for older men. A certain amount of time needs to elapse in the process of acquiring skill. Learning is not strictly a continuous process. When something is learned, it needs to be assimilated and associated with previous knowledge. This results in periods of non-learning following the periods of learning. These non-learning periods are called plateaus by the teacher. The foundryman might look upon them as seasoning periods. While the learner may not be acquiring knowledge, he should be acquiring judgment.

Apprentice training is training in knowledge and skill. A skilled foundryman not only needs to know how and why a job is to be done, but he also must be able to do the job. The acquiring of knowledge may be speeded up through the use of motion pictures or other visual aids, but the acquiring of skill can be accomplished only in the actual doing of the work. It takes just as long to acquire skill today as it ever did. Most of the newly acquired props in education do not apply to acquiring skill. They help in acquiring knowledge, but skill still needs to be acquired by putting in time actually doing the work at which the skill is sought, and by repetition and practice.

D. F. Lane *is supervisor of training for Bethlehem Steel Co., Sparrows Point, Md. He has served an apprenticeship as a tool and die-maker, has worked at the trade, has been master mechanic and foreman, and has received B.S. and M.S. degrees from Pennsylvania State College. He is vice-chairman of the Society's Apprentice Training Committee.*

I am in full agreement with the idea that as a result of training experiences gained in World War II, methods and procedures for imparting skills to new employees have been greatly improved. The use of visual aids, and the application of JIT and JMT are cases in point.

However, although it is true that we can train in a shorter time than previously, I believe that the technology of foundry practice has been greatly extended at the same time. We at Sparrows Point feel that in order for the foundry trade to keep pace with technological developments, higher standards should be established for entrance into the trade, and a higher level of instruction given in such subjects as metallurgy, related machine and pattern shop practice, engineering drawing, and mathematical calculations relating to foundry work.

In some shops it probably would be feasible to apply wartime methods of specialist training of foundry apprentices. This technique would be particularly useful in mass production plants, where the same type of equipment is turned out in large numbers. However, even under these conditions, distinct disadvantages arise whenever the nature of the work or the design of the part might be changed, since all of the employees in that particular unit would have to be re-trained for each new type of work.

For these reasons, we strongly believe that four years is by no means too long a period to develop a first-class mechanic in the foundry. For instance, in our foundry at Sparrows Point we have men who have been with us for ten to fifteen years, and who are still taxed by the problems involved in some of the jobs coming through. While it would be possible to make specialists of our apprentices in six months, or even in one month in some cases, this approach is not practicable for a shop with the variety of work that is handled here, and we do not believe that in the long run it is feasible for any industry.

In further support of our feeling on this matter, I should like to point out that we rotate our apprentices

*Job Instruction Training, a useful training technique for any type of educational program, was sponsored by the government during the war.

from one operation to another, according to an orientation schedule developed as a result of analyzing the trade and conferring with the various shop personnel involved. We also believe that in general it would be helpful to schedule foundry apprentices for at least several weeks in both the pattern and machine shops, since all three trades are closely related. Finally, we believe that it would be useful for foundry apprentices to spend some time in the mechanical and physical laboratories, so as to learn how metals are analyzed and tested and to become familiar with the types of metal with which they are working from day to day. If the above approach is followed in training apprentices for the foundry, I believe that four years will be none too long for proper orientation and instruction, particularly since, as was pointed out above, the related information needed to keep pace with technological developments in the foundry and related industries has been greatly increased in the last few years.

J. A. Bowers, *melting superintendent, American Cast Iron Pipe Co., Birmingham, Ala., started with his company as an apprentice pattern-maker. After completing a four year training period he served as pattern maker for two years and subsequently worked in several departments. He is a member of the A.F.S. Apprentice Training Committee.*

The length of time necessary for the training of foundry apprentices depends on the object of the training. If the trainee is to be a specialist, i.e., a bench molder, or a jolt, squeeze, or sand slinger operator, or a mold finisher, core setter, etc., he probably could be trained in considerably less time than four years. However, such a trainee at the time of graduation is not a qualified molder. He is a specialist, probably well trained in one or two phases of the trade.

A graduate of this type of training knows very little about proper gating methods, proper sand analyses, proper pouring temperature for type metal used, etc. He must have practically constant supervision unless his work is entirely repetitive.

This type of training is similar to the training given during the war to specialty welders, turret lathe operators, etc. The war trained specialty welder certainly could not be termed a journeyman. However, if some one gave him the proper rod he could lay a very satisfactory bead. The same is true of the turret lathe operator trained hurriedly during the war. Some of these trainees after a relatively short time could actually produce more than some experienced journeymen machinist. However, if you were to put such a man on the lay-out table or even on some other type of machine he would be lost, whereas the journeyman machinist would feel perfectly at home. If this is the type of man desired then the short term training should be sufficient and would be the economical method.

When the object is to train a man to be a versatile journeyman molder much more time will be required for the job. Such a man should not only be shifted around on all of the different work in the foundry but should also spend some time in the pattern shop, the cleaning room, and on the cupola as shown in the table below.

MOLDER APPRENTICES

	Hours
Helping Molder	600
Bench Molding and Squeezer Machine	1100
Machine Molding (Jolt, rollover, sandslinger)	1100
Pattern Shop	600
Dry Sand (Large special work)	1100
Core Making	1100
Cupola Practice	600
Cleaning and Inspecting	600
Molding	2200
Related Training	1000

During the 1000 hours spent in school the apprentice is taught the technical side of each phase of his shop training concurrently with his practical foundry work.

While on the cupola he is given fundamental practical operating details including the reason for different metal mixtures. He is also taught the fundamentals of metallurgy. In the pattern shop the apprentice gets a basic knowledge of contraction allowances, pattern making materials, reasons for skeleton patterns, etc. In the cleaning room he learns something of the different specifications that must be met. He also learns to distinguish different types of casting defects. We feel that a graduate apprentice in our foundry is capable of holding a job in almost any foundry.

As pointed out above, the length of training time for foundry apprentices will depend on just what type of man is desired. If a specialist trained in one or two phases of a molder's work is desired, then the short term training should be sufficient and is more economical. However, if a versatile journeyman is desired then the full 10,000 hour training period is necessary. The writer would like to point out that every graduate apprentice in the American Cast Iron Pipe Co. shop is considered a potential supervisor.

Robert Gregg, *a national director of A.F.S., was born on the Isle of Man and started work in foundries there in 1900. Starting in 1907, he worked in Canadian and United States foundries as a molder and coremaker. Before becoming foundry manager of Reliance Regulator Corp., Alhambra, Calif., he held supervisory and consulting positions.*

The length of training time for a young man with a high school education to become a fairly good molder depends a great deal on his natural mechanical ability and his interest in the trade. For a molder, I would venture say 6500 hours in the molding department, 1000 hours in the core room, and 500 hours of class

(Continued on Page 37)

PLAN ALL-CANADA FOUNDRY CONFERENCE

PLANT VISITATIONS, a general interest meeting, and group meetings for steel, cast iron, and non-ferrous foundrymen, have been scheduled for the Second A.F.S. All-Canadian Foundry Conference to be held at the Windsor Hotel, Montreal, September 30-October 1.

In announcing the program James H. Newman, Newman Foundry Supply Ltd., Montreal, who is vice-chairman of the Eastern Canada & Newfoundland Chapter and chairman of the Conference Organizing Committee, stated that 150 hotel rooms have been reserved for the occasion. Single and double rooms are

Canadian chapter officers discussing the 2nd All-Canadian Foundry Conference. Left to right: O. L. Voisard, chairman, Eastern Canada and Newfoundland Chapter; R. A. Woods and J. H. King, chairman and co-chairman, respectively, of the Ontario Chapter; and J. H. Newman, Eastern Canada and Newfoundland vice-chairman, who is in charge of the Conference.

available at the Windsor, Mount Royal, and Laurentien Hotels in Montreal.

Program for the conference, which is open to all foundrymen regardless of A.F.S. affiliation, is as follows:

Thursday, September 30

9:30 a.m.—Registration at Windsor Hotel
12:30 p.m.—Luncheon
2:15 p.m.—Plant Visitations
8:00 p.m.—Motion Picture Film
"River of Paper," courtesy of G. Harold Fisk, Powell River Ltd., Montreal, Que.
8:30 p.m.—General Meeting
"Dust Control in the Foundry," Allen D. Brandt, Bethlehem Steel Co., Bethlehem, Pa.

Friday, October 1

9:30 a.m.—Plant Visitations
2:30 p.m.—Steel Group Meeting
"General Steel Foundry Procedure," V. E. Zang, Unitcast Corp., Toledo, Ohio.
"Laboratory vs. Foundry Controls," I. Ferron, Joliette Steel Ltd., Joliette, Que.
2:30 p.m.—Cast Iron Group Meeting
"Mechanization in the Foundry," I. Shepherd, Beach Foundry Ltd., Ottawa, Ont.
"Cupola Melting," E. C. Winsborrow, Shawinigan Foundries Ltd., Shawinigan Falls, Que.
2:30 p.m.—Non-ferrous Group Meeting.
"Modern Methods of Brass Foundry Operation," J. C. Converse, Crane Ltd., Montreal, Que.
"Molding Methods," H. W. Bennett, Dominion Engineering Works, Ltd., Montreal, Que.

Technical chairmen for the Friday afternoon group meetings are: *Steel*—W. J. Hall, Fahralloy Ltd., Orillia, Ont., and C. V. Hacker, Lynn McLeod Metallurgy Ltd., Thetford Mines, Que.; *Cast Iron*—C. Johnston, E. Long Ltd., Orillia, Ont., and J. Grieve, Dominion Engineering Works, Ltd., Lachine, Que.; *Non-ferrous*—

E. C. & L. Chapter Chairman O. L. Voisard (right) extending invitation through Thomas Cowden, British Columbia Chapter chairman, to all West Coast foundrymen to attend the 2nd All-Canadian Conference.

J. Dalby, Wilson Brass & Aluminum Foundries, Ltd., Toronto, Ont., and H. J. Roast, Montreal, Que.

Vice-chairmen of the Organizing Committee headed by Mr. Newman are M. A. Hughes, LaSalle Coke Co., Montreal, and H. Louette, Dominion Engineering Works, Ltd. Co-chairmen of the Registration Committee are Luce G. Guilmette, Canadian Foundry Supplies & Equipment, Montreal, and John G. Hunt, Dominion Engineering Works, Ltd. The Program Committee is headed by A. H. Lewis, Dominion Engineering Works, Ltd.; the Publicity Committee by R. E. Cameron, Webster & Sons, Ltd., Montreal; and the Housing Committee by J. H. Archambault, LaSalle Coke Co. Plant visitations are under the direction of G. W. Paterson, Refractories Engineering and Supplies Ltd., Montreal, and the Entertainment Committee is under Chairman W. C. Rowe, Crane Ltd.

Sculptor Fingerprints Bronze Statue

"THE REPUBLICANS can make of it what they will, this being an election year, but it seems that a British peer has put the finger on F.D.R." writes Charles T. Post in a recent issue of *Iron Age*.

"The next time you are in London, examine closely the bronze statue of the late President, recently unveiled with fanfare in Grosvenor Square. Perfectly reproduced and visible on the head is a fingerprint of the sculptor, Sir William Reid Dick.

"From Britain's *Foundry Trade Journal*, we learn that the head was cast separately from the rest of the bronze statue by the lost wax process—*cire perdue* as it is known abroad. Sir William stuck his finger on the model when preparing it for the foundry."

EFFECTS OF BORON ADDITIONS ON MALLEABILIZATION OF WHITE CAST IRON

J. E. Micksch *
H. A. Fabert, Jr.*
and
G. M. Cover †

ADDITIONS OF BORON in minute quantities to counteract the stabilizing effect of chromium on the malleabilization of white cast iron is standard procedure in a number of plants,[1] but micrographic data regarding the microstructure are lacking. The object of this investigation was to supply some of these data, and possibly determine an optimum boron content for the maximum acceleration of annealing.

Initial experimentation with boron in cast iron was conducted in the middle 1920's. Cast irons containing one per cent of boron were found unannealable and exhibited a structure which appeared hypereutectic. In 1926 Walter patented boron additions to iron in quantities less than 0.1 per cent. The trend toward the use of more minute quantities was furthered by the work of Martin, who found after extensive experimentation that boron additions of 0.001 per cent considerably accelerated the anneal and counteracted the effect of stabilizers, such as chromium, found in ungraded scrap. These conclusions were of considerable interest in that they were in direct contrast to the properties ascribed to the one per cent boron iron.

By considering chill depth rather than annealing properties Bastien and Guillet [2] found that irons containing about 0.05 per cent boron showed a minimum chill depth when compared with irons of both higher and lower boron content. Although this work was not thought too pertinent with regard to the present investigation because of very dissimilar iron compositions, it was assumed that the work was perhaps indicative of the existence of some certain boron-iron composition which evidenced properties most receptive to annealing.

Summarization of all the investigations mentioned previously led to the selection of the boron range for the present investigation, i.e., 0.00 per cent to 0.05 per cent. A one per cent boron master alloy was used for preparing these boron irons. It was thought that the use of such an alloy, rather than the 12-14 per cent ferroboron, would decrease slag pickup during melting and would facilitate the handling of the small quantities involved.

Two variables were to be considered as a basis for

* This paper, presented at the first Ohio Regional Foundry Conference, is a portion of a thesis submitted to Case Institute of Technology in partial fulfillment of the requirements for the degree of Bachelor of Science in Metallurgical Engineering.

† Associate Professor of Metallurgy, Case Institute of Technology, Cleveland.

AREA	PHASES
AJVL	1. Unsaturated ternary gamma-iron solid solution; maximum carbon content 1.9 per cent; maximum boron content 0.3 per cent.
LVNC	1. Carbon saturated ternary gamma-iron solid solution LV; maximum carbon content about 1.9 per cent and maximum boron content about 0.3 per cent. 2. Cementite solid solution, CN; carbon from 6.6 to 5.3 per cent and boron from 0.0 to 1.7 per cent.
JVB	1. Boron saturated gamma-iron solid solution, JV; carbon from 0.0 to about 1.6 per cent and boron from 0.08 to about 0.3 per cent. 2. Iron boride; boron 8.8 per cent.
VNB	1. Carbon and boron saturated ternary solid solution, V; carbon, 1.6 and boron, 0.3 per cent. 2. Boron saturated cementite solid solution, N; carbon 5.3 and boron 1.7 per cent. 3. Iron boride; boron 8.8 per cent.

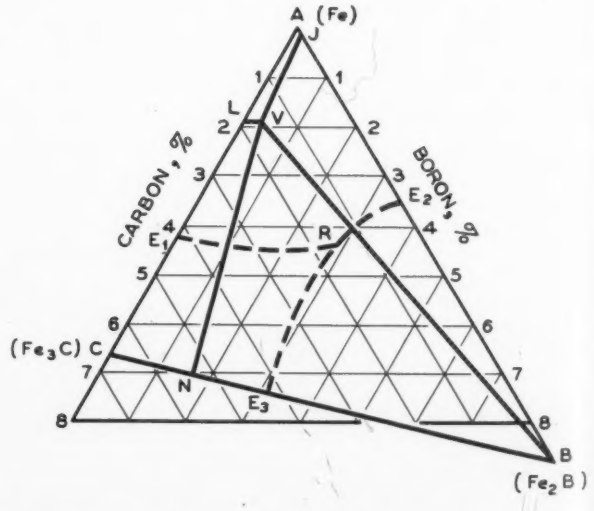


Fig. 1—Section of iron-iron carbide-iron boride equilibrium diagram before transformation.

experimentation: boron content, and first stage annealing periods varying from 2 to 88 hr. The following boron alloys were chosen as a basis for experimentation:

Heat No.	Boron, per cent
1	0.0000
2	0.0005
3	0.0010
4	0.0030
5	0.0050
6	0.0100
7	0.0300
8	0.0500
9	1.0000

Although boron apparently affects both the first and second stages of annealing,[3] because of time limitations only the first stage was investigated. A study of the mechanical properties of the annealed bars would have been of considerable interest, but for similar reasons this also was considered beyond the scope of the present investigation.

Effecting Graphitization

Conversion of a white iron to a malleable iron is effected by the transformation of cementite to free graphite (temper iron) and ferrite. This graphitization is effected by an annealing heat treatment.

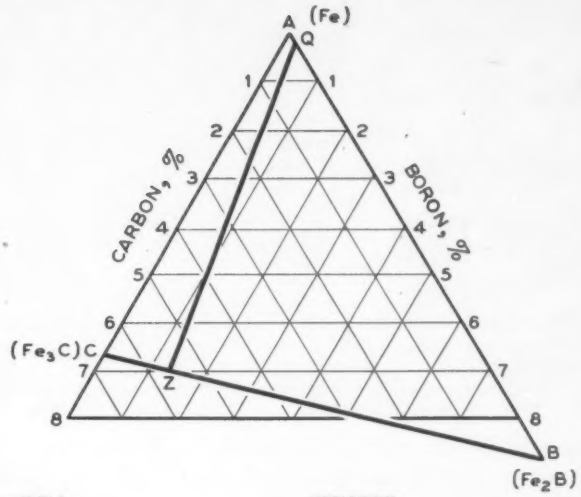
White iron castings prior to treatment consist of free cementite in a matrix of pearlite. The cementite is in a metastable state even at room temperature, but cannot transform to ferrite and graphite because of low atomic mobility. Thermal treatment, however, can increase this mobility to such an extent that transformation is possible, usually within the temperature range of 1640 to 1800 F.

In heating to this range the pearlite is transformed into austenite between 1330 and 1400 F, with the result that the iron consists of free cementite in a matrix of austenite. With continued heating the solubility of cementite in austenite increases. Holding at some higher temperature brings about a precipitation of graphite at points along the austenite-cementite interface. The austenite, no longer saturated with cementite, then is able to dissolve additional cementite.

The process of solution and precipitation, called first-stage graphitization, continues until all of the free cementite is dissolved and most of the carbon is precipitated. The mechanism of graphitization, according to Schwartz,[4] involves "the solution of cementite, its decomposition into constituent elements, the migration of the carbon to points where it can readily crystallize out, and the growth of graphite crystals." The controlling factor in the graphitization process is the dissociation rate of the cementite.

To complete the process of graphitization the temperature is lowered close to but under the critical temperature, which is somewhere between 1400 and 1300 F. Below the critical temperature carbon is not appreciably soluble in iron. The temperature should be dropped as rapidly as practicable to 1400 F, and then slowly through the range from 1400 to 1300 F, where the metal will pass through the critical point.

Below the critical temperature the austenite, which is of eutectoid composition, is unstable and has a tendency to change to pearlite. Some of the metastable cementite will break up and deposit its carbon on the original graphite nodules; the remainder of the carbide will form pearlite. The cementite of the pearlite



AREA	PHASES
AQZC	1. Binary alpha-iron solid solution, AQ; boron from 0.0 to 0.08 per cent. 2. Cementite solid solution, CZ; carbon from 6.6 to 5.5 per cent and boron from 0.0 to 1.4 per cent. 3. When the ternary solid solution, Fe-Fe_3C-Fe_2B, transforms it gives a binary pearlite of two solid solutions, Fe-B and Fe_3C-Fe_2B.
QZB	1. Saturated binary alpha iron-boron solid solution, Q; boron 0.08 per cent. 2. Saturated cementite solid solution, Z; carbon 5.5 and boron 1.4 per cent. 3. Iron boride, B; boron 8.8 per cent.

Fig. 2—Section of iron-iron carbide-iron boride equilibrium diagram at room temperature.

is spheroidized upon holding at a temperature below the critical point, and these spheroids of cementite, in time, are decomposed into ferrite and temper carbon.[5] When all of the cementite has decomposed and the remaining structure consists of temper carbon in a matrix of ferrite, the second stage of graphitization is finished, and the anneal is complete.

If the microstructures of the annealed white iron exhibit massive cementite, the first stage of graphitization was incomplete; if pearlite is evidenced, the second stage was incomplete.

Iron-Carbon-Boron Equilibria

There seems to be a considerable divergence of opinion regarding the iron-carbon-boron equilibria. The work of Hannesen [6] in 1914 appears to be the first of a series of investigations concerning iron and boron and later carbon. The latest work was conducted by Wever and Muller [7] in 1929, and apparently is the most reliable work accomplished to date.

The investigation by Vogel and Tammann [8] gives evidence of the most thorough examination of the system by the construction of a ternary equilibrium diagram. Two isothermal sections from the ternary system explain their interpretation of the phase relationships involved (Figs. 1 and 2).

Heats were made in a 35-kva, 17-lb capacity induction furnace. A vapocarb hump furnace was used for annealing to provide a suitable atmosphere and prevent decarburization. The raw materials were air fur-

TABLE 1—CHEMICAL ANALYSIS

Heat No.	Carbon, per cent	Manganese, per cent	Desired,* Boron, per cent	Analyzed Boron, per cent
1	2.41	0.33	0.0000	———
2	2.21	0.27	0.0005	0.0007
3	2.21	0.26	0.0010	0.0012
4	2.16	0.27	0.0030	0.0025
5	2.16	0.29	0.0050	0.004
6	2.11	0.30	0.0100	0.012
7	2.06	0.29	0.0300	0.028
8	2.21	0.29	0.0500	0.047
9	2.07	0.32	1.0000	———

Silicon, sulphur, and phosphorus were determined only for heat No. 1 and analyzed 1.19, 0.080 and 0.127 per cent respectively.
* Boron additions based on a 90 per cent recovery.

nace white iron and a 12-14 per cent ferrocarbon. All the white iron used came from one 150-lb bull ladle.

The order in which the heats were made was with decreasing boron content, since a one per cent boron master alloy had to be prepared initially from the white iron and ferroboron. Other boron heats were made with the master alloy as the source of boron.

Three-inch anneal bars were first poured in baked sand molds, while excess metal and four $\frac{5}{16}$-in. diameter bars for spectroanalysis were poured in green sand. The excess metal with the four attached bars was shaken out shortly after solidification, but the anneal bars were permitted to cool in the mold approximately one hour before shake-out.

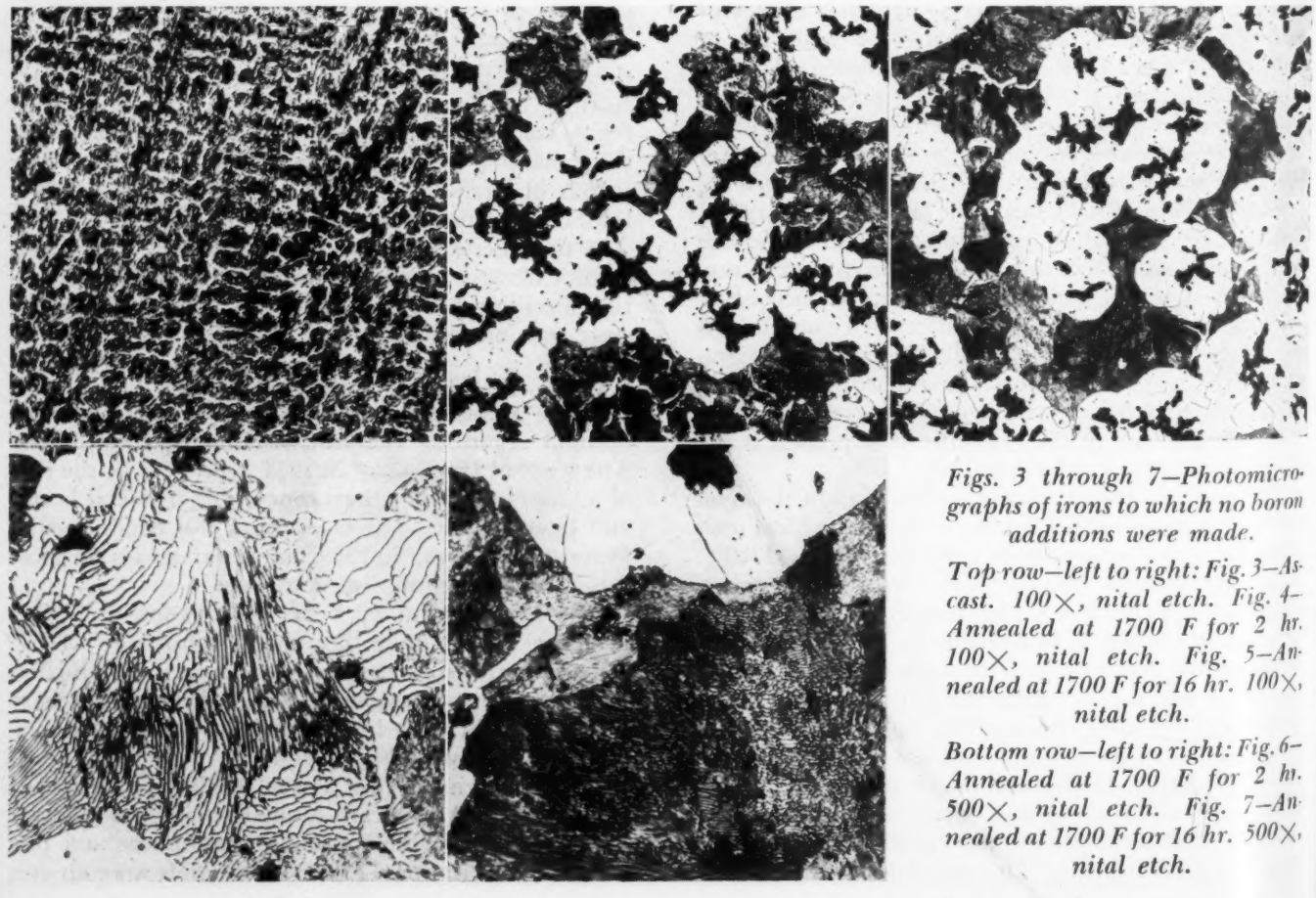
After break-off and prior to annealing, each bar was identified with its heat by grind marks. To facilitate charging and to assure uniform annealing treatment, 35 bundles were prepared by wiring together bars from each of the nine heats. Bundles were charged to the annealing furnace every 2 hr from 6 am to 10 pm for a period of 4 days. All spectroanalysis bars were wired together and received maximum time at the upper temperature, which was maintained at 1700 F except during charging, when a 10-degree drop occurred.

Upon completion of the upper temperature treatment the pieces were cooled from 1700 to 1400 F in $1\frac{1}{2}$ hr. From 1400 to 1340 F, the rate of cooling was 12 degrees per hour; time at the lower temperature was $15\frac{1}{4}$ hr. The charge was cooled from 1340 to 1200 F at a rate of 2 degrees per minute. All bundles were removed from the furnace at 1200 F and placed on a sand bed for cooling. Throughout the annealing period the fluid for the generation of the annealing furnace atmosphere entered the cracking unit at the rate of 35 to 38 drops per minute.

Microstructures Observed

After cooling the bundles were broken, all test bars were fractured, and the bars were marked with both a heat number and a bundle number. Samples from all bars from bundles 1, 12, 24, and 35, representing, respectively, 88, 60, 30, and 2 hr at the upper critical temperature, were examined metallographically to observe and localize any major microstructural changes.

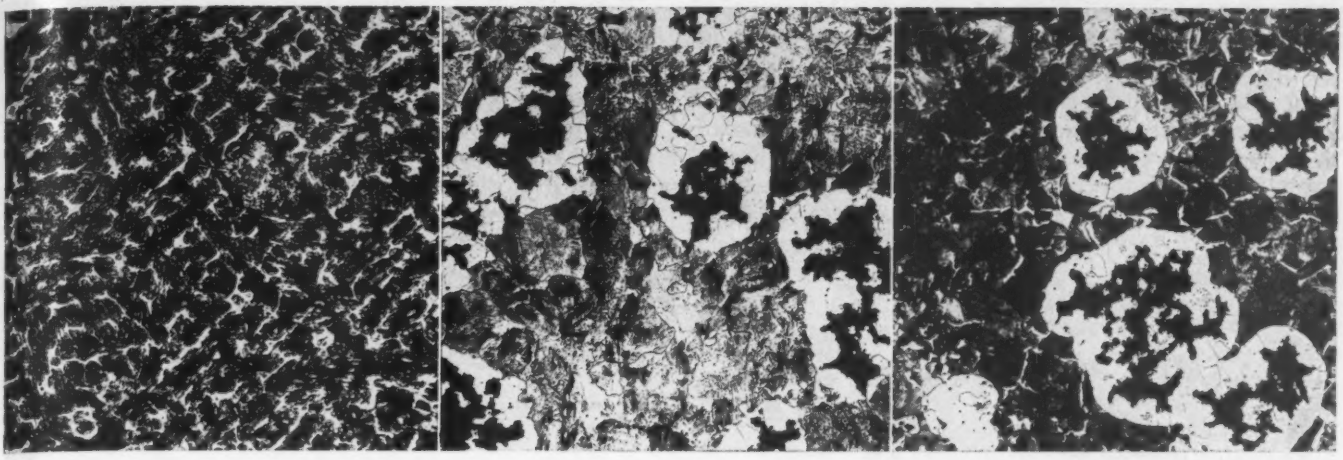
A sufficient change appeared between the 2-hr and the 30-hr sample; the 88, 60, and 30-hr samples exhibited similar microstructures. In order to further investigate the 2 to 30-hr range, samples representing 16, 10, 8, 6, and 4 hr were examined. The 2-hr and 16-hr samples were selected for detailed study. Their microstructures were photographed because they



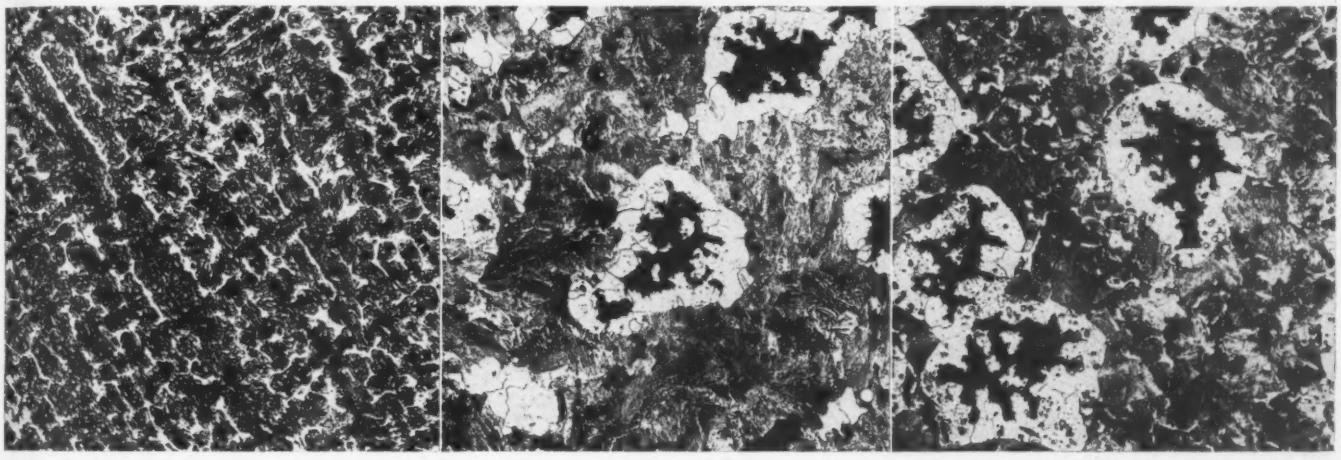
Figs. 3 through 7—Photomicrographs of irons to which no boron additions were made.

Top row—left to right: Fig. 3—As-cast. 100×, nital etch. Fig. 4—Annealed at 1700 F for 2 hr. 100×, nital etch. Fig. 5—Annealed at 1700 F for 16 hr. 100×, nital etch.

Bottom row—left to right: Fig. 6—Annealed at 1700 F for 2 hr. 500×, nital etch. Fig. 7—Annealed at 1700 F for 16 hr. 500×, nital etch.



Figs. 8, 9 and 10—Irons, 0.0007 per cent boron additions. Left to right: Fig. 8—As-cast. 100×, nital etch. Fig. 9—Annealed at 1700 F for 2 hr. 100×, nital etch. Fig. 10—Annealed at 1700 F for 16 hr. 100×, nital etch.



Figs. 11, 12 and 13—Boron additions 0.0012 per cent. Left to right: Fig. 11—As-cast. 100×, nital etch. Fig. 12—Annealed at 1700 F for 2 hr. 100×, nital etch. Fig. 13—Annealed at 1700 F for 16 hr. 100×, nital etch.

seemed to best show the changes involved. To study as-cast structures white iron samples from each heat were also prepared and photographed.

All metallographic specimens were transverse sections, which were worked down on papers from No. 1 to No. 3 grit and given a final polish with rouge on a billiard-cloth wheel. The etchant was 3 per cent nital. Examinations were conducted at 100 and 500 diameters magnification.

Chemical Analysis

Carbon and sulphur were determined volumetrically. The manganese was determined by the persulphate method, phosphorus by the alkalimetric method, and silicon by the sulphuric acid method as described in ASTM Reprint No. E30-36T, dated August 26, 1936. Boron was determined spectrographically (Table 1); a colorimetric method [9] was attempted without success, due to lack of time and inexperience with the method of boron determination.

Because of the reported variance in the solubility of boron in gamma iron [6, 7, 8, 13] two theories were developed regarding the occurrence of a complex carbide. One theory (*A*) dealt with the assumption that the solubility of boron in gamma iron [10] was low, about 0.002 per cent, and the other (*B*) had to do with high solubilities of about 0.3 per cent boron in the iron.

Theory A. At the upper holding temperature (1700 F) two phases existed, a ternary solid solution of boron-carbon-gamma iron and a solution of iron carbide-iron boride. During graphitization the iron carbide of the iron carbide-iron boride solid solution dissolved in the austenite and graphite was precipitated. This precipitation of carbon shifted the composition of both solid solutions to a lower carbon and a high boron content.

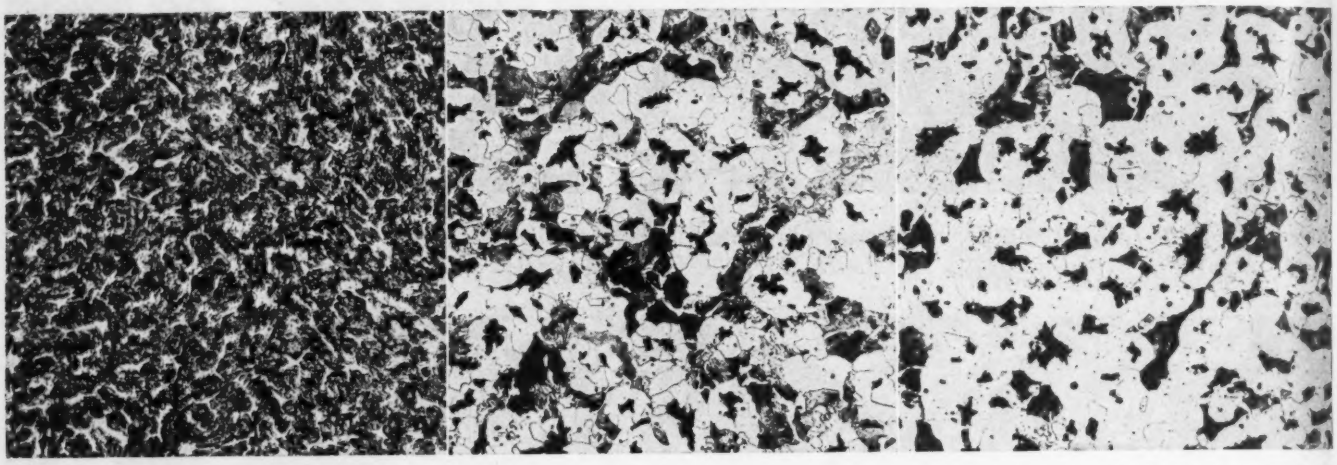
With a boron content lower than the maximum solubility the austenite, after first-stage graphitization was complete, would have a composition somewhere on the line *LV* (Fig. 1). With a boron content greater than the maximum solubility, the first-stage graphitization would cease when the composition reached the line *VN*, and the iron would contain two solid solutions, one of the composition *V*, one of composition *N*, and temper carbon. Thus with boron greater than maximum solubility, iron carbide would be stabilized by the formation of a solid solution of iron carbide with the "left over" iron boride.

Theory B. If the boron solubility in gamma iron were assumed to be 0.3 per cent, then according to the first explanation no complex carbides would exist below 0.3 per cent boron. The explanation for the existence of a complex carbide below 0.3 per cent boron was difficult to comprehend. It was thought that

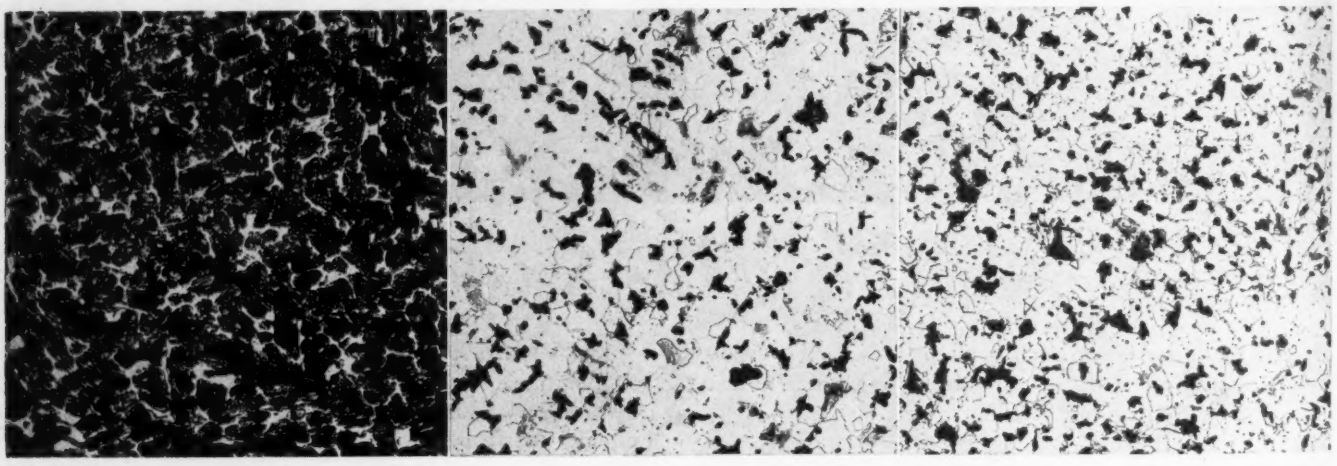
the complex carbide could be best explained by assigning relative magnitudes to the forces in the processes of graphitization and solution. The processes considered were: (1) the crystallization of graphite; (2) the diffusion of carbon in austenite; (3) the dissociation of iron carbide; (4) the solution of iron carbide in austenite; (5) the solution of iron boride in austenite, and (6) the solution of iron boride in the iron carbide.

During the first-stage graphitization the crystallization of carbon from the saturated austenite started the chain of processes. The crystallization of carbon created a concentration gradient which was satisfied by the dissociation of the dissolved iron carbide into iron and carbon, and the iron carbide was replenished from the iron carbide-iron boride solid solution.

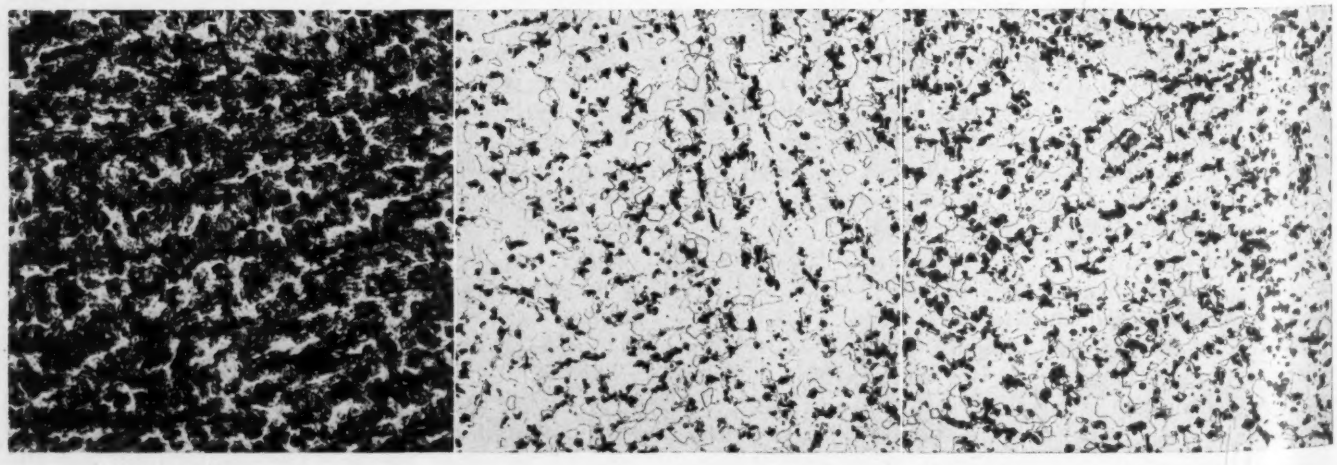
The precipitated carbon moved the composition of



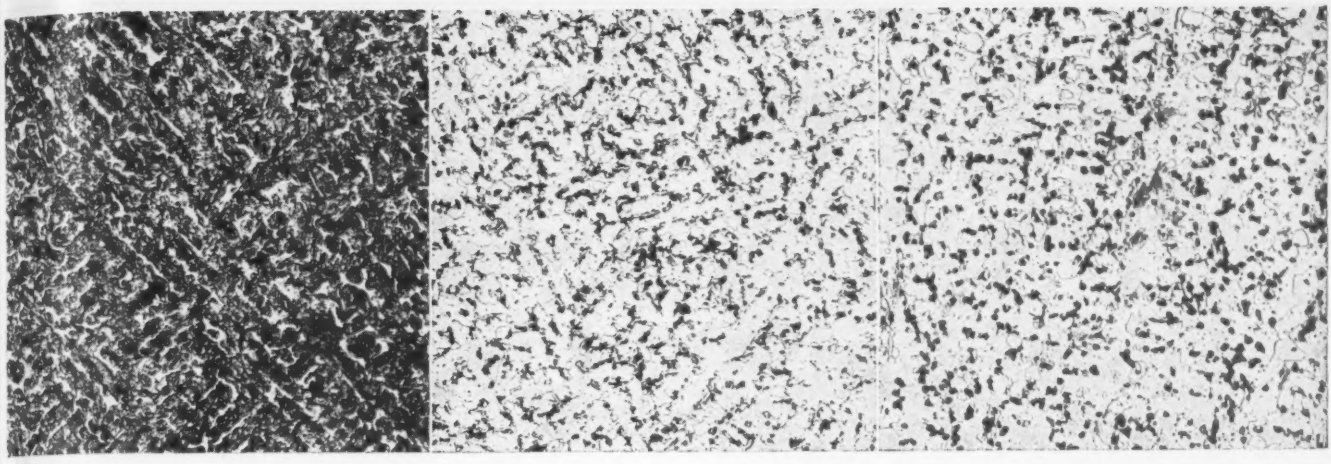
Figs. 14, 15 and 16—Boron additions—0.0025 per cent. Left to right: Fig. 14—As-cast. 100×, nital etch. Fig. 15—Annealed at 1700 F for 2 hr. 100×, nital etch. Fig. 16—Annealed at 1700 F for 16 hr. 100×, nital etch.



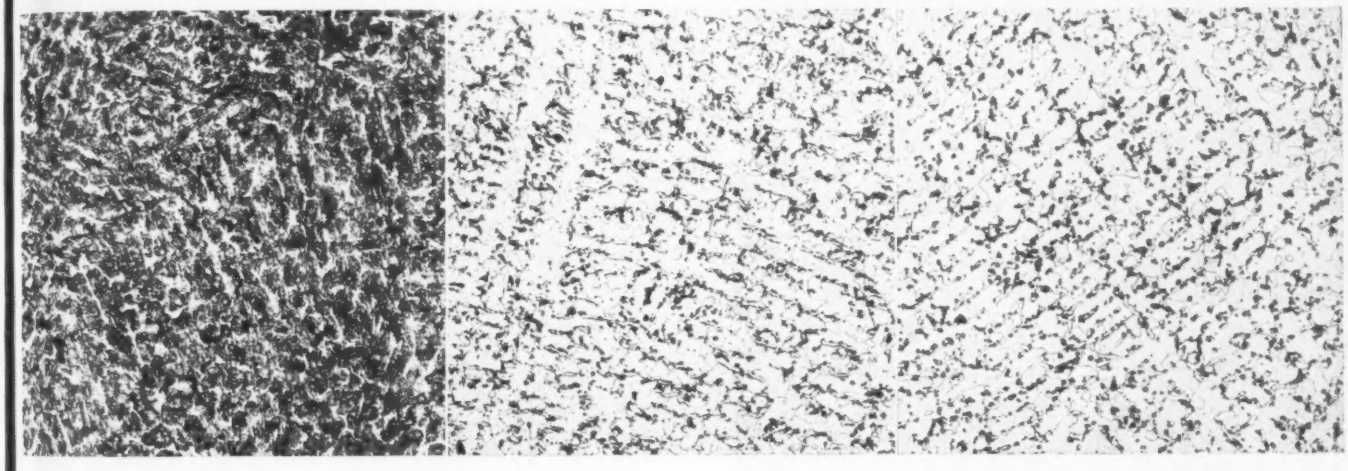
Figs. 17, 18 and 19—Boron additions—0.004 per cent. Left to right: Fig. 17—As-cast. 100×, nital etch. Fig. 18—Annealed at 1700 F for 2 hr. 100×, nital etch. Fig. 19—Annealed at 1700F for 16 hr. 100×, nital etch.



Figs. 20, 21 and 22—Boron additions 0.012 per cent. Left to right: Fig. 20—As-cast. 100×, nital etch. Fig. 21—Annealed at 1700 F for 2 hr. 100×, nital etch. Fig. 22—Annealed at 1700 F for 16 hr. 100×, nital etch.



Figs. 23, 24 and 25—Boron additions—0.028 per cent. Left to right: Fig. 23—As-cast. 100×, nital etch. Fig. 24—Annealed at 1700 F for 2 hr. 100×, nital etch. Fig. 25—Annealed at 1700 F for 16 hr. 100×, nital etch.



Figs. 26, 27 and 28—Boron additions—0.047 per cent. Left to right: Fig. 26—As-cast. 100×, nital etch. Fig. 27—Annealed at 1700 F for 2 hr. 100×, nital etch. Fig. 28—Annealed at 1700 F for 16 hr. 100×, nital etch.

the iron carbide-iron boride solid solution along *CN* toward *N* (Fig. 1), but to establish equilibrium some iron boride in the carbide solid solution dissolved in the austenite and moved the composition back, but not quite to the initial position. The composition of the two solid solutions would be at the ends of the tie line through the new carbon content and, for practical purposes, the original boron content.

The rate of graphitization would be determined by the slowest of the processes 1, 2, 3, or 4, but if a force could be applied to stop graphitization it would have to overcome the combined forces of crystallization, diffusion, dissociation, and solution represented by processes 1, 2, 3, and 4. This force was provided by the solution pressure of iron boride in iron carbide.

Graphitization ceased when the composition of the iron boride-iron carbide solid solution was such that the forces of attraction between iron carbide and iron boride equaled the combined forces of graphitization which were acting on the iron carbide, plus force created by solution pressure of iron boride in austenite.

Consideration was given to solid solution phenomena rather than film theories [11] because there appeared to be little change in the amount of complex carbide in the 12-hr and 88-hr samples. If a film of iron boride were acting to retard graphitization some change in the quantity of complex carbide should perhaps have been evidenced between the two samples because of the increased possibility of diffusion at the longer annealing.

The pearlite curve (Fig. 33) conveys the impression that the amount of pearlite initially increases with boron. This conclusion was not necessarily valid because the boron-free heat was cast directly from the air furnace while the boron heats were remelted during preparation.[12]

From an examination of the higher boron samples it appeared that boron acted as a nucleator during the first-stage graphitization. As the boron increased, the original dendritic pattern of the white irons was progressively outlined by a greatly increased number of graphite particles.

It could not be inferred that boron initially acted as a graphitizer because in all heats the first stage of graphitization was complete. However, it would have been of considerable interest to investigate shorter first stage annealing periods with a view toward determining the minimum time required to effect cementite decomposition. The refinement of graphite particle size was accompanied by a corresponding refinement of the ferrite grain size.

For the range of alloys studied, boron accelerated second-stage graphitization except for heats contain-

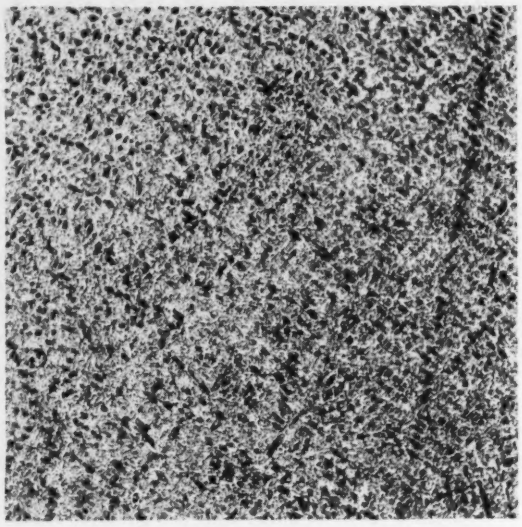


Fig. 29—As-cast. 100×, nital etch.

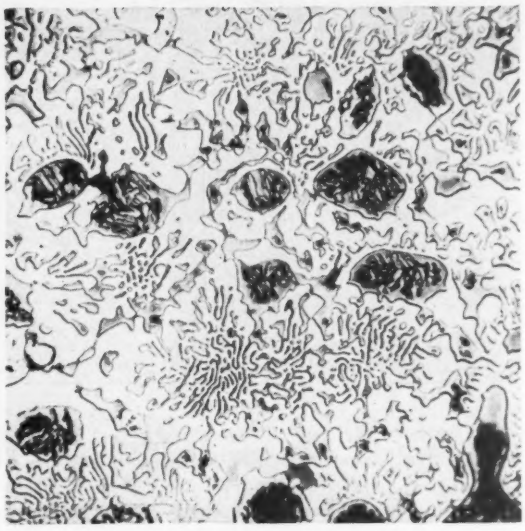


Fig. 30—As-cast. 100×, nital etch, heat tint.

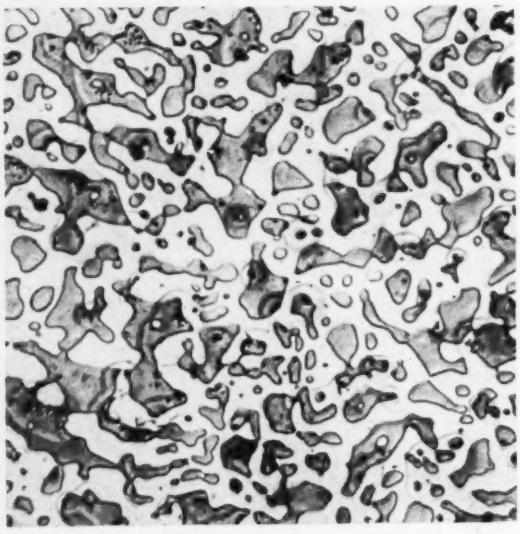


Fig. 31—Annealed at 1700 F for 2 hr. 500×, Stead's reagent.

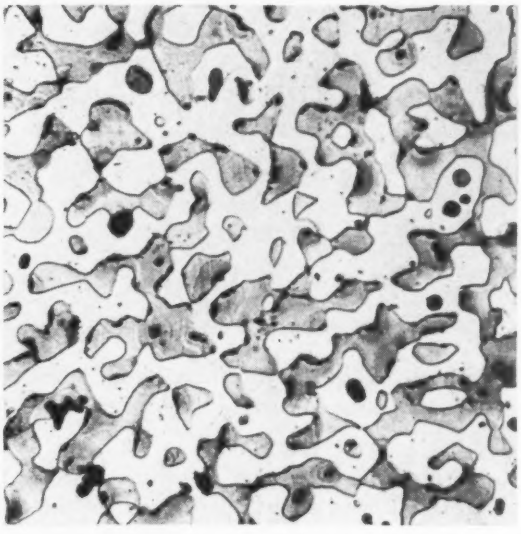


Fig. 32—Annealed at 1700 F for 88 hr. 500×, Stead's reagent.

Figs. 29 through 32—Photomicrographs showing microstructures of irons with 1.0 per cent (approx.) boron additions.

ing 0.0007 per cent boron (Figs. 9 and 10) and 0.0012 per cent boron (Figs. 12 and 13). In these heats no perceptible changes were observed. It also was interesting to note that irrespective of boron content the fineness of the pearlite decreased with decreased time at the higher temperature (Figs. 6 and 7).

The variation in the white iron microstructures was thought insufficient to have an appreciable effect on graphitization. They were not considered further.

Conclusions

The conclusions drawn may be summarized:

1. At approximately 0.0025 per cent boron a complex carbide began to appear, the amount increasing with increasing boron.

2. Graphite nucleation was noticeable at 0.0025 per cent boron and increased with increasing boron.

3. Boron above 0.0025 per cent refined the ferrite grain and graphite particle size.

4. Pearlite decreased with increasing boron; the most noticeable change occurred between 0.0012 and 0.0025 per cent.

5. Since a complex carbide appeared at approximately 0.0025 per cent boron and the amount of pearlite decreased appreciably between 0.0012 and 0.0025 per cent boron, an optimum boron content for the maximum acceleration of annealing may exist within the range of 0.0012 to 0.0025 per cent boron.

6. Irrespective of boron content the coarseness of

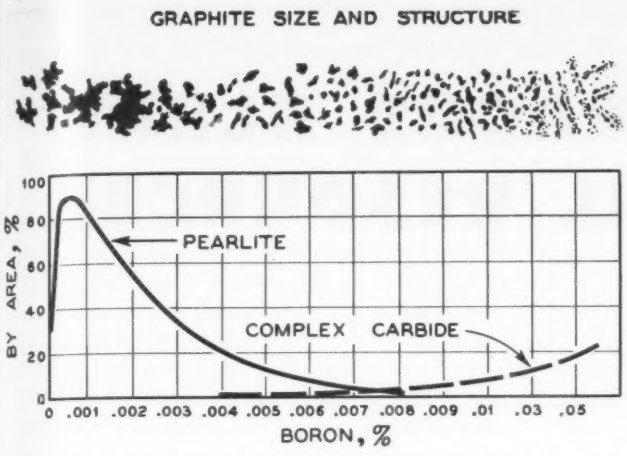


Fig. 33—Graphic summary of microstructural changes.

pearlite lamellae increased with the shorter times at the upper holding temperature of 1700 F.

Acknowledgments

The authors wish to acknowledge the cooperation of Fred Pfarr, Lake City Malleable Co., in supplying raw materials; N. F. Tisdale, Molybdenum Corp. of America, and C .H. Flickinger, Republic Steel Corp., in performing boron spectroanalyses; J. A. Berger, also of the Molybdenum Corp. of America, in supplying binary and ternary equilibria data; Professor K. H. Donaldson, Case Institute of Technology, for his cooperation in all phases of the work; and D. T. Doll, Brush Beryllium Co., for helpful suggestions and perusal of the manuscript. Dr. H. A. Schwartz, National Malleable and Steel Castings Co., L. C. Flickinger and Ralph Langley, Youngstown Sheet and Tube Co., were very helpful with comments and suggestions regarding graphitization theory and analytical procedure, respectively.

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ROUND TABLE

(Continued from Page 27)

room instruction; for a core maker, 5000 hours in the core room, 500 hours in the molding department, and 500 hours in class room instruction.

This schedule is for training men for work in a general jobbing foundry.

The speed-up training of men given during wartime has flooded the country with a lot of half-baked mechanics, not only in foundries but other trades as well. If all mechanics past 45 years of age were taken out of jobbing foundries, it is quite probable that these foundries would have to close their doors.

Robert C. Woodward, *foundry superintendent, Bucyrus-Erie Co., South Milwaukee, Wis., has had extensive industrial experience and has a first-hand knowledge of industrial training problems. A graduate of Stanford University, 1911, he has been metallurgist and foundry superintendent and is president of the A.F.S. Wisconsin Chapter.*

In the Bucyrus-Erie shops a foundry apprentice has a carefully planned course, and is under the guidance of an experienced full time supervisor. He receives training in a large variety of work, and serves some time in each operating division of the foundry. Under these conditions it is felt that the present apprenticeship term, which is three years, is adequate.

In our pattern shop, an apprentice has a four year term. Here, too, he is under a skilled full time supervisor, has a variety of work, and has the advantage of being closely associated with the foundry.

It is believed that longer courses tend to discourage capable young men from starting an apprenticeship.

Government Issues Safety Pamphlets

A SAFETY GUIDE for workers in all types of industrial plants, "Butch Learned the Hard Way", published recently by the Bureau of Labor Standards, U.S. Department of Labor, is the first of a series to appear in conjuction with the President's National Conference on Industrial Safety.

Using the misadventures of "Butch", an industrial worker who has safety lessons brought home forcibly to him through personal accidents caused by his own carelessness, the pamphlet points out the necessity for wearing protective clothing, using machine guards, practicing good housekeeping, prompt reporting of defective equipment, elimination of horseplay on the job, and seeking first aid for even minor injuries.

A limited supply of free copies may be obtained from the Bureau of Labor Standards, U.S. Department of Labor, Washington, 25, D.C. Quantities may be purchased at 10 cents each.

UTILIZING NONFERROUS SCRAP CONSERVES METAL RESOURCES

Earl S. Schwartz
Works Manager
H. Kramer & Co.
Chicago

WASTE OF NATURAL RESOURCES has always accompanied a war period, and this was particularly true in the war just past. Sound business practices were thrown to the winds; normal economies were overlooked, and metal reserves were depleted to the extent that the United States has become a "have not" nation. The Bureau of Mines estimates that, based on normal peacetime consumption, the commercial reserves of nonferrous metals are: Copper, 32 years; zinc, 17 years; lead, 10 years.

An obvious method of extending the period of these reserves is the proper handling, segregation and utilization of scrap metals. This paper will deal with the problems encountered by the smelter and refiner of nonferrous scrap in melting and refining the various grades of secondary metals and producing alloys to strict chemical specifications. The fundamental problems are quite similar for all secondary nonferrous metals. However, this discussion will be confined to the copper-base alloys since, in the sorting, melting, and refining of these alloys, the same problems are encountered as with the other types of nonferrous metals.

Metallurgical processes are available for separating copper-base alloys into their primary constituents, but it is more economical to melt the alloy scrap, refine the molten metal to a definite alloy specification, and cast an ingot for further processing at the foundry and fabricating plant than to attempt to break down the alloy into its component elements. It is this economic advantage, in addition to other factors, that justifies the existence of the secondary nonferrous smelter.

Classify Scrap Materials

Economic advantages of secondary smelters over primary smelters can be more easily realized if the scrap materials are sorted into groups and classes which correspond as nearly as possible to single-grade composition. The reason for this is that metallurgical processes have not been developed for the separation or elimination of certain deleterious elements. The scrap items containing elements which cannot be removed without excessive loss are less desirable in the production of the composition alloy ingot, and must fall, of necessity, into a lower price class. For example:

A grade of copper-base alloy scrap may contain an excessive amount of antimony. With the known metallurgical processes, it is impossible to remove the antimony from the alloy without first removing most of the tin, lead, and zinc present. It can be seen that such a scrap material can be used only in a very selective manner. Either it must go to the primary smelter, where the alloy will be broken down into its component parts, or to the secondary smelter where it can be used only in very small quantities, thus reducing the contamination content by dilution.

Scrap Content Determines Value

Certain other contaminating elements such as aluminum, manganese, silicon, iron, beryllium, chromium, sulphur and others can be eliminated by refining, but they involve metal losses of varying degrees, the use of expensive chemical fluxes, and are time consuming, all of which add to the ultimate cost of the composition ingot produced. Therefore, it follows that the value of the scrap is determined by the quantities of the foreign elements and impurities present, and the relative difficulty of removing these elements from the base alloy.

There are many causes for the contamination of metal scrap, but the following may be considered the most important.

1. Productive Methods During Fabrication: Contamination due to productive methods is normally due to the design and the admixture of the alloys; normally the contamination cannot be avoided. A few instances of this can be noted; the automobile radiator where the tanks may be of a 70 per cent copper-30 per cent zinc brass and the tube or honeycomb made of a relatively pure copper held together with any one of a number of the tin-lead solders.

Another example would be machine cuttings consisting of two or more widely different classes of alloys such as brass and babbitt, or iron, brass and babbitt as produced in the bushing field. There would also be an impregnation of graphite in the bronze bearings and bushings now being used extensively in the powder metallurgical field. This type of contamination will probably continue to increase but, as long as the problem is recognized and these mixtures of alloys and metals are segregated the smelter will continue to treat and refine this grade of scrap successfully.

2. New and Unusual Alloys: More and more during the past 20 years, new and unusual alloys have been developed for specific purposes or for substitution. Elements such as beryllium, chromium, calcium, molybdenum, silicon, and other minor elements have been added to copper or copper base-alloys for the purpose of obtaining certain added physical properties, or the

NOTE: This paper, sponsored by the Chicago section of American Institute of Mining & Metallurgical Engineers, was presented at the Chicago Technical Conference, March 23, 1948.

substitution of one element for another. This problem again is one of recognition and segregation of these new alloys so that they can be put to the best available use on remelting.

One example came to the writer's attention just after the war. The War Assets Administration liquidated a substantial quantity of obsolete surplus castings which were sold to the smelter as Navy "G" metal, supposedly having a nominal composition of 88 per cent copper, 8 per cent tin, less than ¼ per cent lead, and 4 per cent zinc. All of these castings were exactly the same in size and design. The castings were drilled and there was a slight dissimilarity in the cuttings. When the cuttings were analyzed it was discovered that these castings, which apparently were all for the same use, were made of four different alloys.

Some of the castings contained as little as 5 per cent of tin and had as much as 5 per cent nickel; others had a lead content ranging as high as 2 per cent, with the tin range from 5 to 8 per cent. The segregation of these mixed castings was painstaking and costly, and the cost of sorting had to be charged back to the value of the metal.

3. Carelessness: This term, of course, is self-explanatory, and it is a simple matter to correct careless handling of scrap metal. The practice of placing machine turnings from castings of different alloys in the same scrap drum is evidence of improper supervision and lack of explanation of the value of segregation. Carelessness can be corrected by stressing the fact that the mixing of grades of material of different base composition decreases the value of both grades.

Salvage Program Needed

4. Ignorance: The example given under carelessness could also happen because of ignorance, but ignorance of the value of metals is rapidly disappearing, and that which remains today is among the general public and not in the industrial plants. The war years brought to the attention of most people the great importance of metals and waste materials of all kinds. However, in the past 2½ years there has been a great letdown in the conservation and collection of vital metals from the homes and farms of this country, due to a lack of appreciation of the value of scrap materials in peacetime economy.

Tin, of which this country has no reserve, but which is of vital importance in so many industries, including brass and bronze, is again losing substantial tonnages due to the fact that insignificant items such as toothpaste tubes and tin-plated cans are again going to the refuse dumps, never to be recovered. A program of re-education should be started so that these resources of waste materials do not become a complete loss.

5. Inferior Primary Metal: Occasionally some of the primary producers make the so-called virgin metals with percentages of impurities which are higher than normal. These metals are purchased on the percentage of total impurities and not on specification of any particular impurity. For example, the tin produced in this country from Bolivian concentrates is of many grades, sometimes containing as high as 1½ per cent of antimony, and/or 0.20 per cent of arsenic and varying percentages of other elements. Again, the smelter must recognize this type of contamination and be able to cope with it when the metal is returned as scrap.

6. Nonmetallic Impurities and Gangue: This is a mixture of metal with such nonmetallic solids and gangues as the silicon carbides and the tungsten carbides from grinding wheels, or the cutting oils and emulsions from the drill presses and milling machines, or the sand and clays from the foundry shakeouts and cleaning machines. The smelter must recognize the type of non-metallic material present so that he can properly concentrate and refine to reduce the metal losses to a minimum.

Analyzing the Scrap

Before discussing the pricing of scrap, and how values are determined, a trip through a brass and bronze smelting and refining plant would be of value. The metallurgist in the plant must know the analysis of all grades of scrap materials. Some scrap is chemically and spectrographically analyzed. Other scrap materials are hand or mechanically sorted.

The metallurgist calculates his charge and the scrap then goes into a reverberatory furnace. These furnaces may vary in size from 10 to 125 tons, and are similar to the open hearth in the steel industry. The base charge is melted down and, after melting, a complete chemical and spectrographic analysis is made to determine the percentages of all elements present. From this analysis the metallurgist determines the refining processes necessary to remove the objectionable alloying elements.

Refining may be done by the introduction of a combination of chemical fluxes, and the introduction of oxygen or air into the furnace. Close metallurgical and chemical control must be exercised at all times. When the metal has been properly refined, necessary additions are made to the melt to bring it within the chemical specification desired. The melt is then deoxidized and degassified and poured into ingots. The metal is then ready to go to a foundry and restart its cycle in a useful economy.

Intermediate Treatments

Skimmings, grindings, drosses and badly contaminated metals which cannot be economically processed in the reverberatory furnaces are given special types of intermediate treatments to recover their metallic contents. Grindings and fine drosses of low metallic content are mixed with fluxes and fuel and sintered. Skimmings, slag and the sintered grindings then are run through a blast furnace which separates the metallics from the gangue.

Slag from the blast furnace is disposed of to a dump or to manufacturers of insulating materials, while the metal recovered from the blast furnace is run through the reverberatory furnaces for further refining into alloy ingot. These intermediate processes for the recovery of the metallic content are costly and must be charged back to the value of the scrap. In more modern smelting and refining plants, all of the producing units are connected to one of several types of dust collecting units where the smoke is filtered and the solids are collected. The solids in the main consist of zinc oxide, which ultimately finds its way into zinc recovery plants.

Segregation of scrap (nonferrous metals) is governed more or less by the "Standard Classification for Old Metals" as issued by the National Association of Waste Material Dealers. The NAWMD in its circular "R"

issued in 1946, breaks down nonferrous metals into 83 classifications. Of these 83 there are only 23 copper and copper-base alloy classes. However, in addition to the standard classification, a large percentage of the scrap metals sold is on an analysis basis.

In determining the price to be paid for scrap metals, the smelter and refiner must be governed by several factors. First and foremost, the value of the scrap metal must be in relation to the value of the component elements contained in the scrap. That relationship must take into account the necessary smelting and refining costs, administrative costs, sales, freight, and a reasonable profit for converting the scrap into salable alloy ingot.

In addition to the foregoing items, the law of supply and demand will vary the relationship of scrap to primary metals to some degree. For example, the standard 85 per cent copper, 5 per cent tin, 5 per cent lead, 5 per cent zinc alloy ingot, which under normal conditions sold at about two cents per lb under the price of the primary metals contained, today can be purchased from the smelters and refiners for as much as five cents per lb under the price of the primary metal. This, of course, is possible only because at this particular time scrap metals available are in relative equilibrium with the demand for the alloy ingot.

Mixing Scrap Affects Value

As a specific example of contamination affecting the value of the scrap, take the case of a machine shop which produces 20,000 lb of scrap borings. Of this amount 10,000 lb has a composition of 88 per cent copper, 8 per cent tin, zero per cent lead and 4 per cent zinc; the other 10,000 lb has a composition of 83 per cent copper, 4 per cent tin, 7 per cent lead and 6 per cent zinc. The nonleaded scrap would have a value of 17¾ cents per lb, and the leaded alloy a value of 13¼ cents per lb, or a total value of $3,100 for the segregated 20,000 lb. Suppose that through carelessness or ignorance the two types of borings were mixed so that there would be an average analysis of 85½ per cent copper, 6 per cent tin, 3½ per cent lead and 5 per cent zinc. The value of the mixed borings would be 14 cents per lb, or $2,800 for the 20,000 lb, a loss of $300 to the producer of the scrap.

It may be asked why the value of the scrap decreases when it still contains the same number of copper-tin-lead and zinc units after mixing the borings. That is true, but when the materials were mixed the nonleaded borings became contaminated with a new element. That element was lead, and the mixed borings could not be used to make a nonleaded alloy. Therefore, the value of the nonleaded scrap was decreased.

Another example illustrating a decrease in values due to lack of segregation occurs in those plants handling the nickel-silver alloys. It is usual for these same plants to process stainless steels. The scrap from the processing, when kept separate, has respective values when sent to the proper scrap disposal concerns. If the scrap is mixed the stainless steel usually becomes worthless, and the nickel-silver decreases in value due to the fact that elimination of the iron and chromium by refining is a costly process.

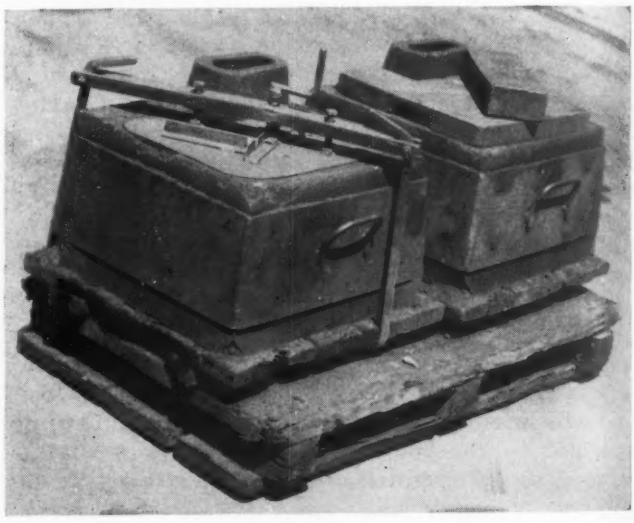
In conclusion, it is important that scrap metals be segregated into single classifications as much as possible in order to attain full ultimate use and value. It also is extremely important that all scrap metals and waste materials, contaminated or not, be routed in some fashion to a consumer of waste materials, for some manner of use will be found for it.

The natural resources of this country can be conserved if the value of collection, segregation, and utilization of scrap materials is but recognized.

Mold Clamp Eliminates Weighting

CLAMPING OF SNAP-FLASK MOLDS to prevent cope raise is replacing the time-honored practice of weighting to secure snap-flask molds to bottom boards, at the Mahwah, N.J., plant of American Brake Shoe Co. Developed by two students from Columbia University working at the plant last summer, the clamping device (shown at left in illustration) weighs 23½ lb, and can be easily transported to the mold by one man and screwed onto the top of the cope.

It has been found that through the use of this device the incidence of cope raise has dropped to virtually



zero and the physical effort required both in weighting the flask and in pouring off the molds has been reduced substantially.

As a precautionary measure, care must be taken in utilizing the clamping device to insure that the pressure plate bears firmly, but not hard, against the cope. If undue pressure is applied, it can cause a drop or crush in the mold. However, with a little care in training of men in its use, this problem is negligible.

According to an article appearing in the company's publication, *Brake Shoe News*, one of the student workers, Clark M. Price, Jr., conceived the idea for the device while changing 100 lb weights on a side floor. He enlisted the aid of a fellow student-worker, Alan D. Kattelle, and the two of them presented the idea to the plant superintendent, and as a result received a plant award for their idea, which is being adopted for use on snap-flask floors throughout company plants all over the country.

Alan Kattelle, who graduated this June from Columbia, is back with Brake Shoe and is participating in a two-year apprentice training course for engineering and metallurgical graduates who are considered of supervisory caliber.

DESIGNING AND RIGGING FOR CORE BLOWING

H. J. Jacobson
Industrial Pattern Works
Chicago

IT IS MANY CENTURIES since man discovered that he could melt metal and cast it into objects to serve his needs. The molder and the patternmaker have come a long way since that time. Today the United States is the greatest industrial nation, and the foundry industry played an important part in making it the great nation it is.

The major part of this remarkable progress has been accomplished in the past thirty years. During that time a great change has taken place throughout this vast industrial empire. The foundry industry, during this period, has changed—it might be said—from a "crude art" into an "exact science." This "exact science" may be more appropriately termed "mass production technique."

Machines and tools are gradually taking the place of skilled craftsmen in the production phase of the foundry industry. The blowing of cores is one of the most important developments that has taken place in a great number of years. A machine and a tool, the core blower and the blower core box have taken the place of the craftsman, the core maker. When the engineer designs and rigs a core box for the blower he is building into the core box some of the skill of the craftsman it has replaced.

The basic principle in designing any tool is to have it so well engineered that no one part will wear out faster than another, and it must best serve the purpose for which it was made. Like the proverbial "one horse shay" which was a vehicle so well made that after a century of use it one day collapsed, every part having worn out at exactly the same time.

A core box is a precision tool of the foundry, made to produce accurate cores, from which precision castings are to be made. When a core box is rigged for the core blower, it is being subjected to one of the severest conditions known for any precision tool. It must withstand the pressure of a punch press and the grinding, cutting action of the sand blast.

At the present time there is a great difference of opinion on many questions regarding the design and rigging of core boxes for the blower. Like any other pattern problem it is almost impossible to lay down any standard rules covering this subject. Usually each job presents its own problems.

The purpose of this paper is to arrive at conclusions of a general nature regarding the best design, material and technique to be used for a core box of average size and shape. It is hoped that from these conclusions, knowledge will be gained for the use of larger or smaller cores of a similar nature.

The machine on which the core box is to be used must be considered. There are available many makes of core blowers of different designs, but their basic principles are the same. They embody:

1. A reservoir for sand,
2. An inlet for compressed air into this reservoir,
3. An outlet through which sand is blown into the core box.

Its very simplicity is what makes it such a highly efficient part of the modern core room. Production increases with the core blower, over the hand-ram methods, have been phenomenal. However, in many cases, these increases have been false because expensive core boxes have been completely ruined due to improper design and rigging.

There are two types of machines for blowing small and medium-size cores.

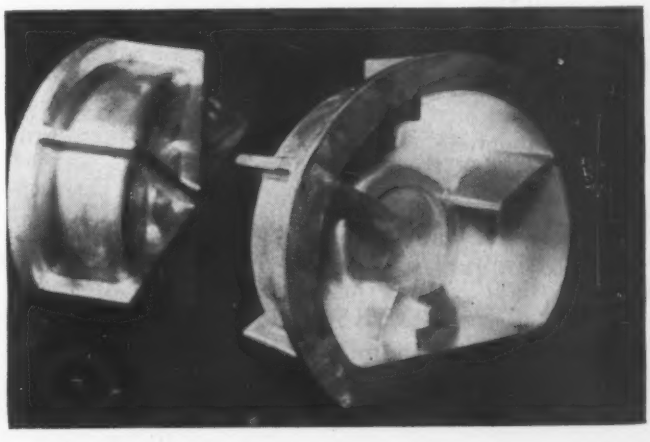
1. The machine designed for vertical split boxes,
2. The machine designed for horizontal split boxes.

Three Core Box Types

Basically there are three types of core boxes in common use.

1. The dump core box (Fig. 1) which is a solid box, made to load and draw through the same end.
2. The 2- or 3-part split core box (Fig. 2) open on two ends, such as the gang-pin core box, usually with

Fig. 1—Dump core box positioned in front of a mirror to show the back end in reflection.



the parting in a vertical position and cores dried in the on-end position on the flat core plate, and

3. The booked-type core box, or completely enclosed box (Fig. 3) usually blown with the parting in a horizontal position. The name "booked" has been derived from the days of hand ramming where each half of the box was filled and the loaded halves were "booked" together forming a full core (usually run with a core dryer).

This paper will be confined to two general types of machines and three general types of core boxes.

In choosing an example for discussion, the field of foundry mechanization should be considered. Also, a core job should be chosen which would be typical of a great number of core problems that come up daily in the foundry business. The type of job chosen should cover the widest possible scope of the subject to be discussed.

Figures 3 and 4 show the type of core job mentioned, the pattern equipment having been engineered by one of the finest pattern engineering departments in the automotive field. Every detail was carefully studied and the design was blue printed and changes made from time to time as experience with blowing problems made it necessary. The job is being run as a 2-gang completely enclosed or booked-type box with parting in a horizontal position using two lower halves and one upper.

Consider Weight and Wear Resistance

The deciding factors in the choice of a core box material are its weight and wearing quality. For the size of box shown in Fig. 3 the choice would be between cast aluminum or cast magnesium. Although magnesium is a lighter metal than aluminum its wearing quality has not been definitely proven under the blower.

The aluminum used by the author is a good grade of pattern aluminum free from pin-hole porosity. Density of the metal is essential to the life of a blower core box because porosity, even if very slight, will give the sand a chance to start a cutting action.

Before any machining is done on the casting, several test cuts are made in the deepest parts of the cavity about $\frac{1}{16}$ in. below the skin with a free-cutting tool. Usually if the cavity is sound the parting of the casting is sound also. All ingot metal should be used and heavy sections should be chilled. Nitrogen gas has been helpful in preventing gas or pinhole porosity.

The analysis of the aluminum alloy used for this purpose is as follows:

Copper	2.5 to 4.0 per cent
Silicon	5.0 to 6.5 per cent
Magnesium	0.15 per cent max.
Iron	1.0 per cent max.
Nickel	0.2 per cent max.
Manganese	0.5 per cent max.
Zinc	0.7 per cent max.

The high silicon makes it possible to pour at comparatively low temperature which makes it ideal for core box and pattern castings.

General Shape of Box

The general shape of any core box is controlled by the shape of the cavity or group of cavities. The box should not be made too great in weight, yet it must withstand blower pressure without distortion.

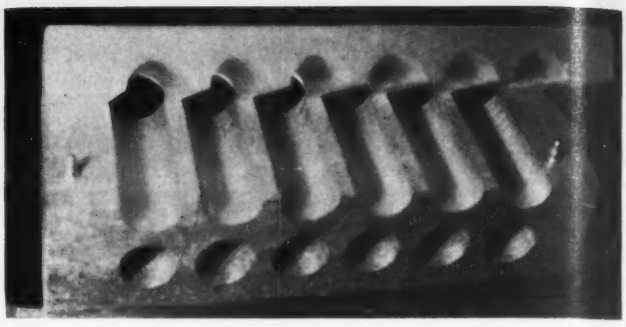


Fig. 2—Three-part split core box open on two ends.

This particular box (Fig. 3) has the main ribbing around the outside back of the box, following the general contour of the cavity. This brings the pressure of the clamping action of the blower close to the cavity edge, assuring a tight seal at the core box parting. Besides this outer ribbing there are two cross ribs in the center. The wall sections are $\frac{3}{8}$ to $\frac{7}{16}$ in. thick.

It has been the general thought on small blow boxes to make them square or rectangular in shape, with box-type ribbing, for positioning in the blower. This is important, but much consideration should be given when designing the shape of the box, so that most pressure from the ribbing is applied directly above the cavity outline. It has been proven that this design of ribbing will add greatly to the life of the parting material.

Locating Box in Blower

Locating the box in the blower so that the holes in the blow plate line up with the holes in the box can be done in several different ways. The use of stops either on the table under the box or directly on the blow plate seems to be the general practice. Where the cavity shape permits making a box square or rectangular in shape, no additional provisions are necessary on the box.

In this case (Fig. 4) the bottom steel plate, which is $\frac{3}{16}$ in. thick plus a reinforcing strip of $\frac{1}{4}$ x $\frac{3}{4}$ in., is used on the inside right hand corner when the box is placed on the machine. In other words, the stops on the machine strike against this steel bottom plate of the core box which has two edges at a 90-deg. angle on one corner.

For maximum production, facilities must be provided for the operator to handle the box quickly. Here we provide a finger grip on the outside lower edge of the steel bottom plate for the operator to grip and slide box quickly from the blower.

The work table directly in front of the core blower is the same height as the blower table which makes it unnecessary for the operator to lift the box. The operation is "slide in and slide out."

The upper half of the box is made to protrude about $\frac{1}{2}$ in. on each side, forming convenient finger grips for the operator in drawing upper half from lower half.

The size and number of blow holes and the size and number of vents tie in closely. Theoretically, when blowing a core the operator replaces the air in the cavity with sand of the proper density. The

object is to exhaust the air only through the vents provided and not through the parting of the box or through some other weak point.

Provide Ample Vent Areas

The faster the sand enters the cavity, the greater the impact, and therefore, the harder the core. If a book-type box without vents were to be blown, the only place the air could escape would be through the parting. So the theory is that it is much better to "over vent" a core box than to "under vent" for maximum life of parting material.

The upper and lower halves of this core box have an equal number of vents. This box is rigged to give maximum permeability to the sand core. There should be very little built up back pressure through the parting, the air having a free flow through the vent areas. Besides the slotted vents the parting is

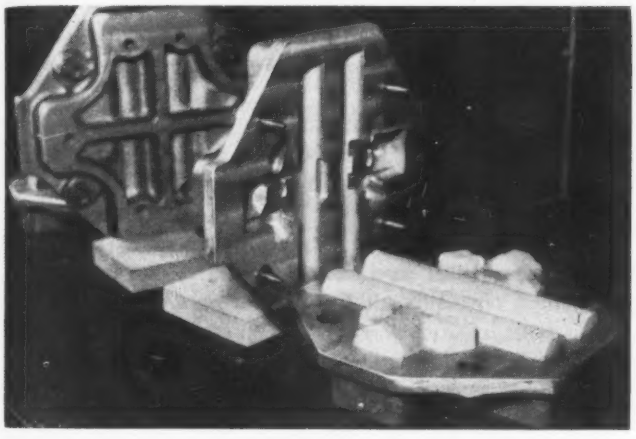


Fig. 3—Booked-type core box positioned in front of a mirror to show the back ribbing in reflection. This is the core box before it is rigged, less vents, facing, blow tubes, and inserts.

completely vented around the entire cavity with 3/32-in. diameter holes 1/2 in. apart. This also helps to prevent a leak in the parting material causing the air to be directed through the 3/32-in. holes instead of continuing out through the parting.

The three 1/2-in. blow holes in each cavity equal an area of 0.59 sq. in. The total effective vent area is 2.95 sq. in. Therefore there is a ratio of approximately 5 to 1, exhaust over intake, without considering the air that might vent through the parting.

There are ninety 3/8-in. diameter vents; four 1/2-in. diameter vents; four 5/8-in. diameter vents, and four 3/4-in. diameter vents.

The blow bushings are made of cold-rolled steel, pack hardened. They are made to protrude into the cavity 1/16 in. and have a thread in the lower end so the sand in the blow hole will not draw out and become a part of the core.

Facing on Partings

The parting on a book-type core box is usually the weakest point and must be replaced several times during the life of the core box. Steel and brass seem to be the materials most preferred for this purpose.

There are three factors to consider when choosing a material for core box facings:

1. Maintain good seal,
2. Edges must stand up,
3. Cost of replacing.

In this particular case (Fig. 3) brass is used because it is easier to replace and bring back to the original cavity line, and it seems to wear as well as steel in this application.

The thickness of the facing should be held to standard dimensions either 1/16 (0.062) or 1/8 (0.125) in., so that when it is replaced the original dimension of the box will be held. Usually the entire parting face of a core box is covered with facing, but wherever possible, the pressure of the clamping action must seal the box at the cavity edge because if the sand cannot get into the parting, it cannot cut the facing material. In this respect (Fig. 4) a marginal facing is used 5/8 in. wide around the entire cavity of the box, directly under the outside ribbing. This will assure uniform pressure around the cavity edge without distorting the box.

None of the facing materials, regardless of hardness or abrasion-resistant qualities, will give satisfactory service unless a perfect seal is maintained during the blowing operation.

Steel Inserts Under Blow Tubes

It is almost always necessary on an aluminum or magnesium core box to provide steel inserts or some other material under the blow tubes. The inserts are of a size that takes in the entire lower half of the box up to the facing material and are made to be replaceable when worn out. On short-run jobs the insert can be a small round piece set in of a size large enough to cover the blast area. Thin sheet copper has been used by laying it on the top of the cavity surface under the blast. In the core box shown in Fig. 3 the author uses cold-rolled steel, case hardened.

A blower core box must be kept parallel on the clamping surfaces to insure a good seal on the parting. For this reason steel is used to prevent the box from wearing out of line. The bottom plate on the box must stand the wear of sliding in and out of the blower. The top plate must be heavy enough and supported by ribbing underneath to prevent buckling. It was found that 1/8-in. steel was too weak, hence the present design calls for 1/4-in. plate on top and 3/16-in. plate on the bottom.

There is no blower core box built that will give maximum life and maximum production unless it is maintained. Maintenance of tools and machines is just as important as the designing and rigging. A regular service should be established and the core boxes inspected every 24 hr.

There has been much controversy over the wear resisting quality of one metal over another, and it would be a great advantage to the industry if this question could be settled definitely. An attempt was made to evaluate the blast resisting quality of one material over another.

1. The specimens of materials tested were approximately 4 in. sq. x 3/4 in. thick, machined smooth and true on one surface before the wear resistance test.

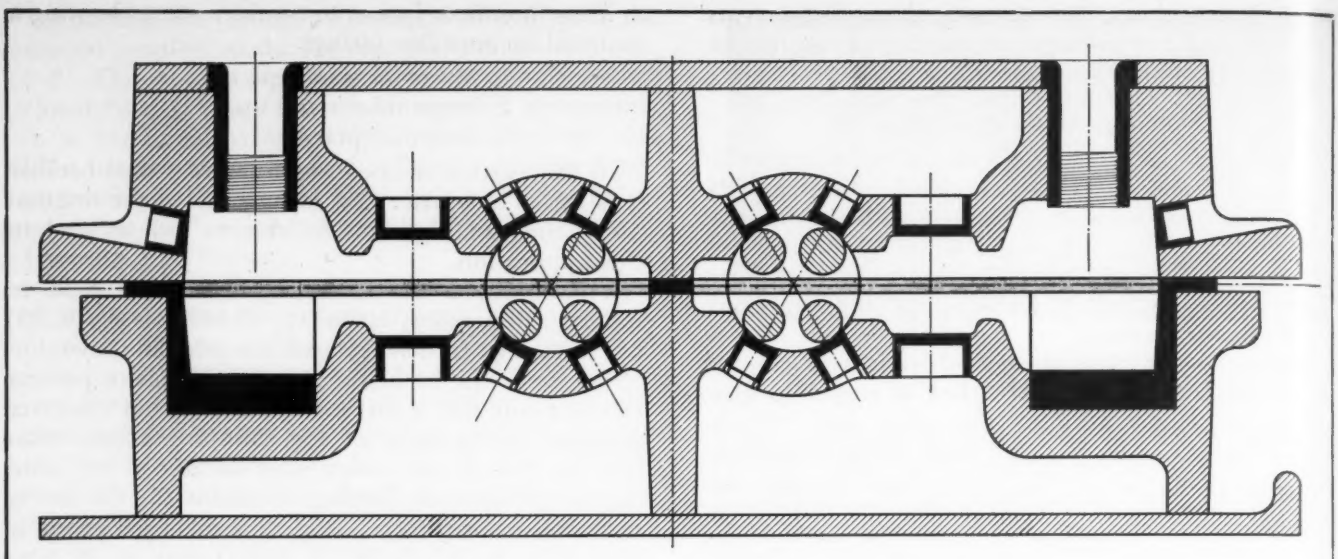


Fig. 4—Drawing of core box for automotive application.

2. A steel plate 4 in. sq. x ¼ in. thick with a 1-in. diameter hole in the center was clamped onto the true machined surface to serve as a masking.

A sandblast machine of the open type, in which none of the sand can get back into the system, supplied all new sand throughout the test.

4. Washed silica core sand No. 60 grit was used under 90-lb pressure through a nozzle opening of ⅜ in. diameter directed into the center of the 1-in. diameter opening in the steel plate.

5. The nozzle was clamped into a rigid position and the specimens were all placed 2 in. from the end of the nozzle.

6. Using a stop watch each specimen was given a 2-min. blast at a point near the center and two 1-min. blasts at two other points on the same surface.

7. The pressure gage on the tank and the pressure gage on the sandblast machine were watched to see that the pressure did not vary.

8. The depth of cut was measured with a ball point dial indicator to 0.0001 in. to the lowest point of cut (excluding pits).

9. Depths of cuts of the two 1-min. blasts were added to that of the one 2-min. blast and an average 2-min. reading obtained.

10. Table 1, Column 3, shows the average depth of cut at the lowest point of wear.

11. Column 4 shows the percentage of efficiency of each specimen, using cold-rolled steel as 100 per cent, the other materials rating from this point. This would mean that if a core box made of cold-rolled steel lasted 100 hr, one made of sheet brass or rolled brass would last 76.5 hr.

12. Column 5 shows the condition of the surface of each specimen after the test.

Although this test does not exactly simulate actual conditions of the sand action when blowing a core, it should tell something of the wear resisting quality of one machineable material over another.

It is interesting to note that in both cases where steel was hardened its resistance to abrasion was lessened. Drill rod steel drops from 145 to 50.6 per cent and cold-rolled steel drops from 100 to 63.7 per cent after hardening. Samples of cold-rolled steel were tested after cyanide hardening and salt bath carburizing with almost the same results.

The first test was made with cast iron comparable to the iron that would be purchased by a pattern shop for a core box casting. Because of the comparatively poor rating of this particular iron, a piece of close grain inoculated iron was used. This specimen

TABLE 1—BLAST RESISTANCE TEST OF CORE BOX MATERIALS

Item No.	Material	Average Depth of Cut, In.	Per Cent of Efficiency	Condition of Surface
1.	Drill Rod	0.0029	145.	Very smooth
2.	Copper (Hard drawn)	0.0031	135.	Very smooth
3.	Cold Rolled Steel (flat)	0.0042	100.	Very smooth
4.	Brass (Sheet)	0.0055	76.5	Very smooth
5.	Aluminum (Sheet)	0.0060	70.	Slight roughness (peened effect)
6.	Cold Rolled Steel (Hard)	0.0066	63.7	Very smooth
7.	Brass (85-5-5-5)	0.0083	50.6	Slightly rougher than No. 5
8.	Drill Rod (Hard)	0.0083	50.6	Very smooth
9.	Aluminum (Chill Cast)	0.0095	44.2	Smooth
10.	Inoculated Cast Iron	0.0099	42.5	Same roughness as No. 7
11.	Aluminum (Not Chilled)	0.0102	41.2	Pitted, 1/64 holes, 1/16 to 3/16 apart
12.	Magnesium (Sheet)	0.0120	35.	Very smooth
13.	Cast Iron	0.0130	32.3	Very rough
14.	Magnesium	0.0210	20.	Smooth
15.	Lead	0.0410	10.2	Rough
	LIGHT METALS COMPARISON			
1.	Aluminum (Sheet)	0.0060	158.	Slight roughness
2.	Aluminum (Chill Cast)	0.0095	100.	Smooth
3.	Aluminum (Not chilled)	0.0102	93.	Pitted
4.	Magnesium (Sheet)	0.0120	79.	Very smooth
5.	Magnesium (Cast)	0.0210	45.2	Smooth

tested slightly under aluminum (chill cast), and the aluminum specimen had a much better surface.

A gang-pin core box made of rolled aluminum stock rated 70 per cent would outlast the best iron box rated at 42.5 per cent. Due to the difference in material weights, it is possible to make the aluminum box in a larger size with a greater number of cavities.

It will be noted that in all cases rolled material has a better rating than cast material. Rolled brass rated 76.5 per cent against cast brass (85-5-5-5) 50.6 per cent. Rolled aluminum rated 70 per cent against the best cast aluminum of 44 per cent. Cold-rolled steel rated 100 per cent. Rolled magnesium rated 35 per cent, whereas cast magnesium rated 20 per cent.

The cast magnesium does not rate as high as aluminum. However this would not necessarily mean that magnesium is not a good core box metal. When the need is for large core boxes where weight is an important factor and where the blast is not too close to the opposite side of the cavity, or where provisions can be made to protect the blast area, magnesium could still be considered a good core box material.

Conclusions

1. Complete cooperation between pattern shop and foundry so that design can be predetermined at blue print stage.
2. Density of the core box material is important.
3. Design of ribbing and general shape of box should be given careful consideration.
4. For maximum production consideration should be given as to whether it is necessary to provide special features to enable operator to handle box.
5. Proper location and size of blow holes and vents should be recognized as a means of prolonging the life of a blower core box.
6. Consideration should be given to the advisability of using brass or copper as a parting material.
7. When using light metals, provisions should be made to protect the area under the blow hole by a means which would be in direct proportion to the production requirements expected from the core box.
8. Machines and tools must be kept in first class condition for maximum production.

Committee Advocates Built-In Dust Controls On Industrial Equipment

DUST HOUSINGS OR ENCLOSURES for machinery and equipment producing dust and fumes should be an integral part of the design of such machines, it was advocated at a recent meeting of the Sectional Committee on Safety Code for Exhaust Systems of the American Standards Association. The Committee represents 24 national, governmental, technical and trade organizations, including the American Foundrymen's Society.

There is little more reason for such machinery and equipment being furnished without provisions for effective dust control than there is for furnishing such equipment with unguarded gears, in the opinion of the committee.

The manufacturer, the committee stated, has intimate knowledge of the operating action of his equipment, the air currents which it may create, and the access points needed for inspection and maintenance. As a result, he can cooperate with dust and fume control engineers to produce workmanlike enclosures with provisions for proper exhaust system connections as an integral part of the machines.

While this practice may result in some increase in the purchase price of the equipment, the committee stated, it would prove economical to the user in the long run. This is due to the fact that some means of controlling dust and fumes must otherwise be provided locally, usually at a higher cost and frequently improperly designed and fabricated.

Enclosures and housings designed to give proper air flow that will effectively exhaust contaminated air would assure protective, dependable control with minimum air volumes, thus simplifying and reducing the size of the exhaust system. The most effective way of accomplishing this is for the dust and fume controls to be incorporated integrally into the machines at the time of their manufacture, the committee concluded.

Urges Improved Mining Technology To Offset Decreasing Ore Supplies

A TURNING POINT in mineral exploitation and utilization had been reached during World War II and in the year immediately following it, according to *Illinois Mineral Industry in 1946*, a recent publication of the Illinois State Geological Survey, which states that the period during which minerals were obtained from rich, favorably placed deposits such as the Mesabi range, the oil fields of Texas and the Connelsville coking coal deposits, is nearing its end.

Today, the volume states, we are entering an era wherein it will be necessary to make use of lower grade materials or less accessible sources for iron ore, copper, lead, zinc, coal and petroleum. Cited particularly is the recognized limitation of the iron ore deposits of the Lake Superior district, for which alternative sources must be sought.

Potentially, these sources are available from vast tonnages of low-grade ore in the Lake Superior district, or from high-grade deposits in Canada, Cuba, Venezuela, Brazil, Sweden, Sierra Leone, Labrador, and Chile.

Three clearly indicated steps in the conservation and efficient utilization of the nation's mineral resources are:

1. The reduction of loss and waste in present mining practices.
2. A program of ore discovery, including discovery and measurement of "sub-ore."
3. A program of technological improvement through research to improve efficiency of resource utilization.

Technological improvement in the mineral industry, the volume states, begins with the technique of exploration. Closely associated with this is the technique of mineral recovery—in the near future, low-grade, mineral bearing deposits not now considered minable will have to be used and technology must find a way to do it. This, according to the book, is particularly true of lead and zinc.

Copies of Report of Investigations No. 127, *Illinois Mineral Industry in 1946* may be obtained from the Geological Survey Division, State of Illinois, 100 Natural Resources Bldg., Urbana, Ill.

GRAY CAST IRON
Relationship of Composition and Properties

R. G. McElwee
Manager, Iron Foundry Div.
Vanadium Corp. of America
Detroit

IN THE PRESENTATION of any discussion of the relationship between composition and properties of gray cast iron it is apparent that the first logical step is a review of the effects of those elements usually considered in a specification. This includes all of the elements which normally are covered by a plain iron recommendation, as is the procedure of SAE, rather than the establishment of chemical specification. The basis of selection, or percentage, of each of these elements and their relationship to each other is as follows:

Carbon: Until quite recently it was considered that carbon was incapable of close control and therefore a wide range was assigned, or worse still, no definite limits were given. The adoption of ASTM specifications ranging from Class 20 iron at 20,000 psi to Class 60 at 60,000 psi tensile strength has led to the selection of higher strength specifications to overcome difficulties of casting performance when, in many cases, the real remedy is the selection of an iron having a combination of properties other than higher tensile strength, often tending to produce sounder castings.

Higher Carbon Level Desirable

Such procedures, producing castings less subject to casting strains, have solved many troublesome defects where the selection of a higher strength value would accentuate the trouble. It is the purpose of this paper to present the advantages of a higher carbon level, which include lower shrinkage, higher deflection and, with a proper adjustment of silicon, any reasonable strength and hardness.

It will be shown that a more careful selection of carbon and silicon can easily effect economies of manufacture in both the machine shop and the foundry. Higher total carbon involves higher graphitic carbon, which is responsible for better performance in applications involving heat resistance and wear resistance.

Silicon: This is the adjustment element in gray iron castings. By the proper selection of the silicon range a casting can be made at any reasonable hardness level, assuming that the silicon selection considers the carbon level and the section size. The matrix can be kept pearlitic and the amount of graphite will depend upon the selection of carbon. It will be explained later in the paper that hard or white iron edges do not fall within this hardness control, but represent a separate problem to be dealt with by a well-known and accepted technique of iron founding.

Manganese: The function of manganese is to form a compound with the sulphur which removes the sulphur from solid solution in iron and causes it to be present as inoffensive inclusions. Specifications of 0.60-0.80 per cent are the usual practice and will fix sulphur provided the amount present does not exceed 0.15 per cent. One other effect of manganese in amounts greater than those mentioned should be noted. It is occasionally used for stabilizing pearlite, which it does efficiently without causing hard spots, but with some sacrifice of machinability.

Sulphur: This element is unquestionably a necessary evil. Much of this element comes from the fuel used in melting and it is desirable to specify a maximum compatible with the available raw materials and methods of melting. This value is quite universally accepted as 0.12 per cent.

Phosphorus: In automotive castings it is quite generally agreed that the top limit of phosphorus should be 0.20 per cent. There are cases, where the casting design is necessarily intricate and the range of section broad, in which a lower value would be desirable. The reason for establishing a maximum is that an excessive amount of phosphorus tends to promote shrinkage. One reason for this might be that the formation of iron phosphide extends the period of freezing.

A chart, shown in Fig. 1, indicates the sensitivity of iron to cooling rate. In this chart the tendency of iron to cast white at extremely high cooling rates has been ignored. This has been done because chilled edges on castings should not be considered in the same light as variations in the hardness of gray cast iron.

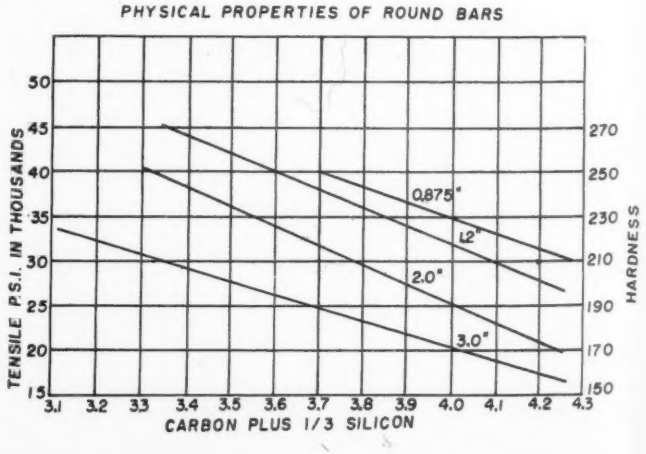


Fig. 1—Sensitivity of iron to cooling rate. Example: An iron showing a total carbon of 3.30 per cent and silicon of 2.10 per cent will have a carbon plus ⅓ silicon value of 4.00 per cent. The BHN will be approximately 230 in a 0.875-in. bar and 170 in a 3-in. bar.

NOTE: This paper was presented at the summer meeting of Society of Automotive Engineers, in French Lick, Ind., June 6-11, 1948. Published by permission of the Society.

Techniques, such as inoculation, have made it possible to cast relatively hard material in quite thin sections without the danger of white iron edges as a result of the high cooling rate. The curves presented in Fig. 1, therefore, presuppose that the casting is entirely gray. In this region the relationship of hardness to cooling rate and composition is well known and can be quite accurately predicted.

The tendency of any iron to produce chilled edges is not strictly a function of composition. Chill depth is related to a number of factors of melting such as moisture in the blast, relative volume of air, weight of coke and other conditions of manufacture which should be within the control of the foundryman.

It is true, however, that there is a limit beyond which castings should not be designed with the expectancy of complete absence of chill. For instance, a vane on the rotor of a water pump, which has a right-angle corner and is $\frac{3}{32}$ in. thick, might be expected to show chill in a sufficient number of cases to cause machining difficulty. On the other hand, it has been found feasible to make a casting $\frac{1}{8}$ in. thick, without sharp corners, if mold conditions are favorable.

The alignment chart, Fig. 2, was constructed from a large number of experiences from many foundries and a wide variety of applications, and can be used to indicate average analyses that will produce a hardness of approximately 200 BHN at the various thicknesses encountered in casting design.

Figure 3 shows the correction to be made for an adjustment of hardness from the 200 level established

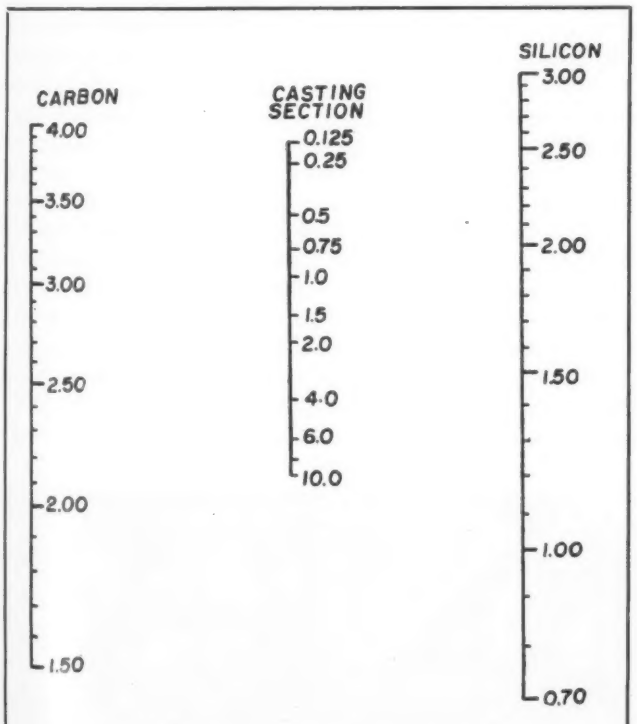


Fig. 2—Composition-section alignment chart for 200 BHN. Example: It is desired to make a 1 in. thick casting from an iron of 3.60 per cent TC and obtain 200 BHN. A line drawn from 3.60 per cent TC through 1-in. section extends across 1.55 per cent silicon, which is the correct value, with the usual tolerance of ± 0.10 per cent.

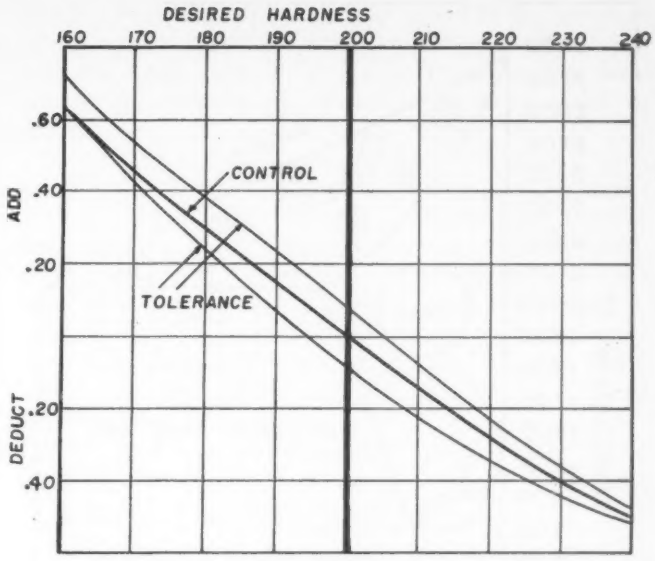


Fig. 3.—Suppose that in the example given under Fig. 2 it is desired to reduce the hardness to 187. The control line crosses the desired hardness at plus 0.20 per cent silicon which, when added to 1.55 per cent (the value for 200 BHN) gives 1.75 per cent silicon.

by the alignment chart. The range of this adjustment is necessarily limited by the deviation that can be permitted without encountering excessive iron carbide or ferrite in the casting. The chart shown in Fig. 1, indicated the relative hardness of the same iron in the standard ASTM test bars, which are $\frac{7}{8}$, 1.2, 2 and 3 in. in diameter.

Numerical values for various types of iron shown across the bottom of this chart (Fig. 1) are known to the metallurgist as "carbon equivalent" and represent a convenient method for the foundryman to assign a single measurement to the carbon and silicon in iron for comparative purposes. It assumes that additional silicon will be one third as effective as the same amount of additional carbon in their effect on structure and hardness of gray cast iron.

In compiling the data used in Fig. 1, various types of iron were poured in all of the accepted test bar sizes, and in each type of iron the entire range of bars was poured so that the section sensitivity would be truly representative.

Simple calculations will establish that the cooling rate of a wall is approximately the same as a cylinder of twice the diameter. That is, a 2-in. test bar will have the same hardness as a casting 1 in. thick. This indicates that there are no satisfactory test bars for castings over $1\frac{1}{2}$ in. thick, although for practical purposes the 3-in. bar can be used as a pilot for castings of 2 in. to $2\frac{1}{4}$ in. in thickness.

It is the accepted practice in making heavier castings, such as dies, etc., to use an arbitrary test bar which has been found experimentally to approximate the cooling conditions of the casting. Tension and other tests are usually made from one of the ASTM standard bars, and in a great many cases the engineer and foundryman have fallen into the error of using the 1.2-in. test bar for all sorts of work regardless of dimensions.

This may be convenient from a testing standpoint, but unless the hardness of the bar approximates the

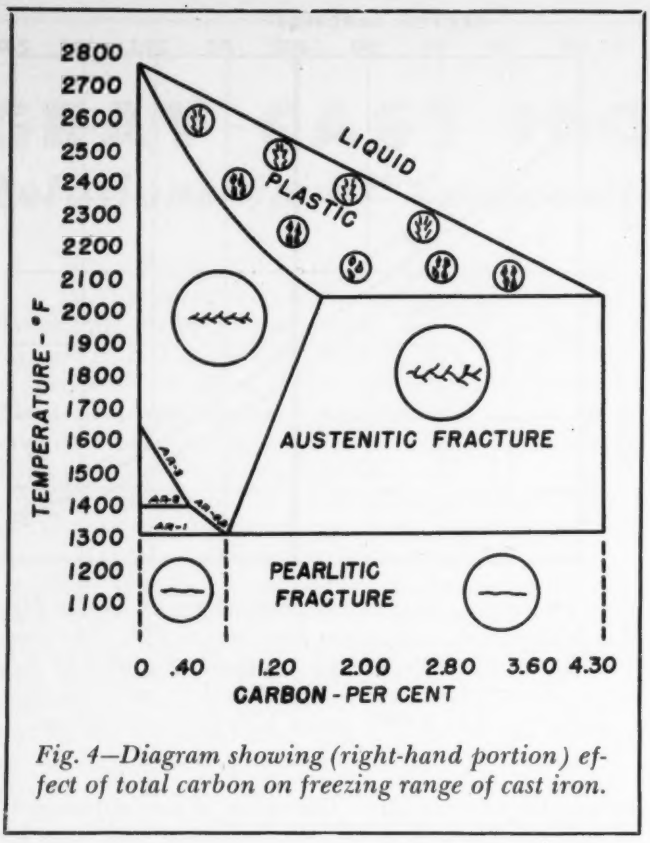


Fig. 4—Diagram showing (right-hand portion) effect of total carbon on freezing range of cast iron.

hardness of the casting this simplification of standards can be very misleading. For any repetitive critical casting it may be necessary to establish arbitrary test bar diameters on an experimental basis if reasonably close control is necessary.

It was mentioned earlier that the first consideration in preparing a specification should be the establishment of the carbon level. The accompanying chart, Fig. 4, explains the reason for selecting the highest carbon compatible with minimum strength required.

Fig. 5—Photomicrograph (below) showing relative hardness of ferrite and pearlite in iron containing 4 per cent total carbon. The ferrite has BHN of 146 and the pearlite falls in the range of 226-255 BHN, the latter being the load-carrying value of the iron. Right—This photomicrograph shows structure of the 4 per cent total carbon iron to be predominantly pearlitic.

It can be seen from an examination of the chart (Fig. 4) that lower total carbon cast irons have a longer freezing range, that is, a longer range of temperature from the time that they have ceased to be purely .iquid until they are completely solid. It is in this plastic or "mush" period that many of the difficulties with castings arise, and the narrowing of this period is obviously advantageous.

Shrinkage continues throughout the plastic period, but the iron "feeds" with great difficulty and, if proper feeding cannot be accomplished, many small voids known as microporosity or open iron are generated. It can be seen that the narrower the plastic range the less is the tendency toward microporosity.

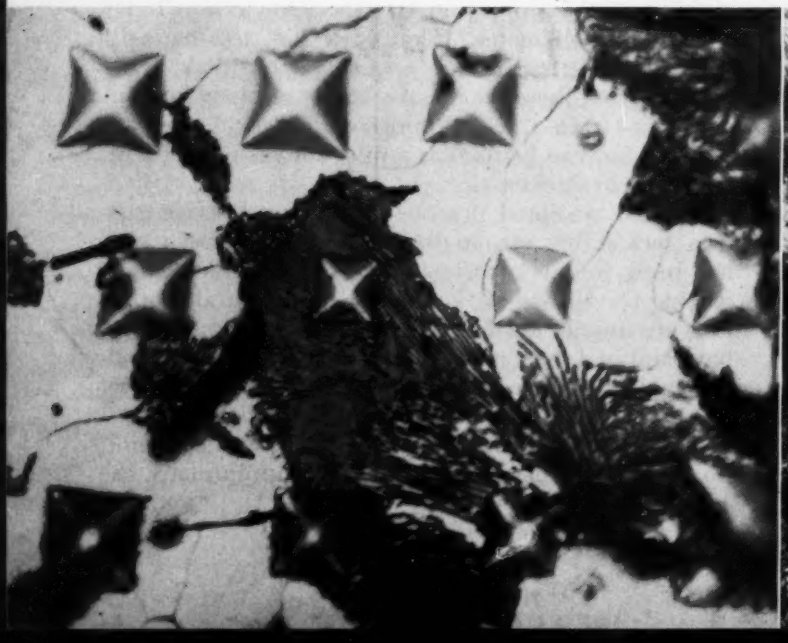
Selecting Iron Composition

By using high total carbon, the same matrix structure and hardness can be obtained at the higher carbon level as with the lower carbon, provided silicon is adjusted in the opposite direction by the amount indicated on the alignment chart (Fig. 2). There is a distinct economic advantage in running relatively high total carbons. The necessity for feeding with external risers is reduced, and castings generally are sounder.

Since the engineer must ultimately be concerned with relative economies of producing different types of iron, he should know that in specifying high tensile strengths and low total carbons he is directly affecting the cost per ton of iron poured. It has been the experience of the author that the percentage of yield can be improved from values as low as 65 per cent to as high as 85 per cent by a better selection of iron composition. In most cases this improvement need not carry a penalty in casting strength, although test bars may give a misleading high value in the former case.

Naturally the higher total carbon iron will contain more graphite. Lest this be considered a disadvantage it should be mentioned that leakage does not occur through graphite particles. Instead, the low carbon iron of low graphite under a given set of conditions usually will show a greater tendency toward microporosity than a relatively high carbon iron made with the proper amount of silicon, even though the graphite particles are more numerous. It is this microporosity which usually is responsible for leakers.

Because of an existing specification on Brinell hardness, it is sometimes difficult to substitute the more advantageous higher carbon unless the engineer is



willing to modify Brinell hardness specifications. The photomicrographs shown in Fig. 5 indicate the fallacy of attempting to regulate the performance of an iron, with respect to wear, on the basis of Brinell hardness.

The iron used for this example, which was of 4.00 per cent total carbon, showed a Brinell hardness of 146, yet the microhardness of the pearlite fell in the range of 226 to 255. This latter value is the load-carrying value of the iron. While it is true that this type of iron will show greater deformation under concentrated loads, it is an excellent material in those cases in which the unit pressures are well below the limit at which deformation begins. Some records of high graphitic irons show many times the life, in resisting wear, of lower graphitic irons of the same matrix structure.

Mention was made of a technique available to the foundryman for preventing chilled edges. This is known in the foundry as inoculation. There are two types available. The first and most widely used is a graphitizing or softening agent which has the proper reaction with chill producing tendencies to eliminate the chill and slightly reduce hardness.

There are cases, however, in which it is desirable to make a casting of increased hardness and still maintain freedom from chilled edges. This is accomplished by a material known as a stabilizing inoculant which, in effect, is a hardening alloy combined with reaction elements which reduce chill. The practical purpose of this type of material is to provide the foundry with a means of making castings harder, with a given base iron, without danger of chilled edges.

Comparable Material Values Unnecessary

Many of the difficulties encountered in securing castings to meet conditions, in which design is necessarily complex, have been the result of a preconceived notion that the casting must have certain values comparable to other materials of engineering when a thorough investigation would indicate that these values are not only unnecessary but, in some cases, undesirable. A case in point is the modulus of elasticity.

Many foundrymen have exhibited considerable pride in their ability to produce an iron approaching the modulus of steel, or 30 million psi. In parts requiring resistance to heat shock it should be remembered that gray iron is a rather poor conductor of heat and that a high heat gradient can be built up in a casting, such as a brake drum, in a very short period of time. If, for instance, the inside of the drum attains a temperature of 700 to 800 degrees higher than the outside, the tendency toward failure is terrific if the iron is of such stiffness that the stresses generated by the heat cannot be relieved by expansion of the outside of the casting.

In such applications an iron of relatively low modulus permits a movement of one part of the casting relative to another without destruction. It should also be remembered that the high graphite which attends the low modulus iron contributes to higher deflections which are, of course, related to low modulus and are a contributing cause for the better performance of unequally heated castings. The very lack of continuity of the matrix caused by graphite particles may also be a factor in stopping those incipient heat cracks which are later causes of failure.

The factors just described are also related to a valuable property of gray iron as an engineering material, namely, damping capacity. This seems to be, for practical purposes, a straight-line function of graphite content and again calls for a relatively high carbon iron in the specification if vibration is encountered in service.

All of the foregoing presupposes the selection of gray iron for any specific application on a basis of the merits of that material, and not as a comparison with another material such as steel. The advantages of wear resistance, resistance to heat shock, relatively high fatigue ratio, comparative ease of manufacture, machinability and capacity for heat treatment seem to be sufficient in themselves to justify the use of cast iron for more, rather than less, of the component parts of modern mechanisms.

It is hoped that a wider understanding of the factors attendant upon sound casting design will extend the usefulness of this important material.

Exhibit Long-Time Corrosion Tests

CASTING ALLOYS OF 17 TYPES were included in the National Bureau of Standards underground corrosion exhibit which was on display in the Bureau's laboratory in Washington, D.C., until August 15. In connection with comparative field tests of the corrosion resistance of various pipe materials in different types of soils, 3000 test specimens were exposed at 15 test sites throughout the United States for periods ranging from five to 14 years.

Measurements of loss of weight and depth of pitting have been made on the 85 varieties of materials exposed and a report is in preparation. Materials tested include seven types of wrought iron and wrought alloys, 17 types of cast iron and cast alloys, 22 types of steel, 13 types of copper and copper alloys, and miscellaneous samples of lead, zinc, metallic- and nonmetallic-coated pipe, and asbestos-cement pipe.

Insulating Firebrick Effects Savings In Rotary Hearth Furnace Operation

LIGHTWEIGHT INSULATING FIREBRICK which replaced heavy firebrick in a large rotary hearth furnace at its Beaver Falls, Pa., plant has resulted in savings in fuel, time and maintenance, the Babcock & Wilcox Tube Co. reports.

The rotary hearth furnace at Beaver Falls is 57½ ft in diameter, with 13½ ft rotating hearth. Lightweight insulating firebricks were used for lining on the exposed furnace face, the suspended roof and the walls. The furnace has been operating since early September of 1947 to heat billets for piercing in the manufacturing of seamless tubing.

After a weekend shutdown it is possible to bring this furnace up to a temperature permitting steel to be charged within an hour-and-a-half, as compared with an eight-hour period for similar furnaces lined with heavy firebrick, officials of the company state.

Although the Beaver Falls rotary hearth furnace is believed to be the first large furnace of its type to use lightweight insulating firebrick, two other companies are having similar installations made and an earlier furnace is being converted to use a flat arch of insulating firebrick in place of its original sprung arch of heavy firebrick.

Tapping the cupola in a Dutch foundry. The cupola is the melting medium generally used in the foundries.

NETHERLANDS FOUNDRIES

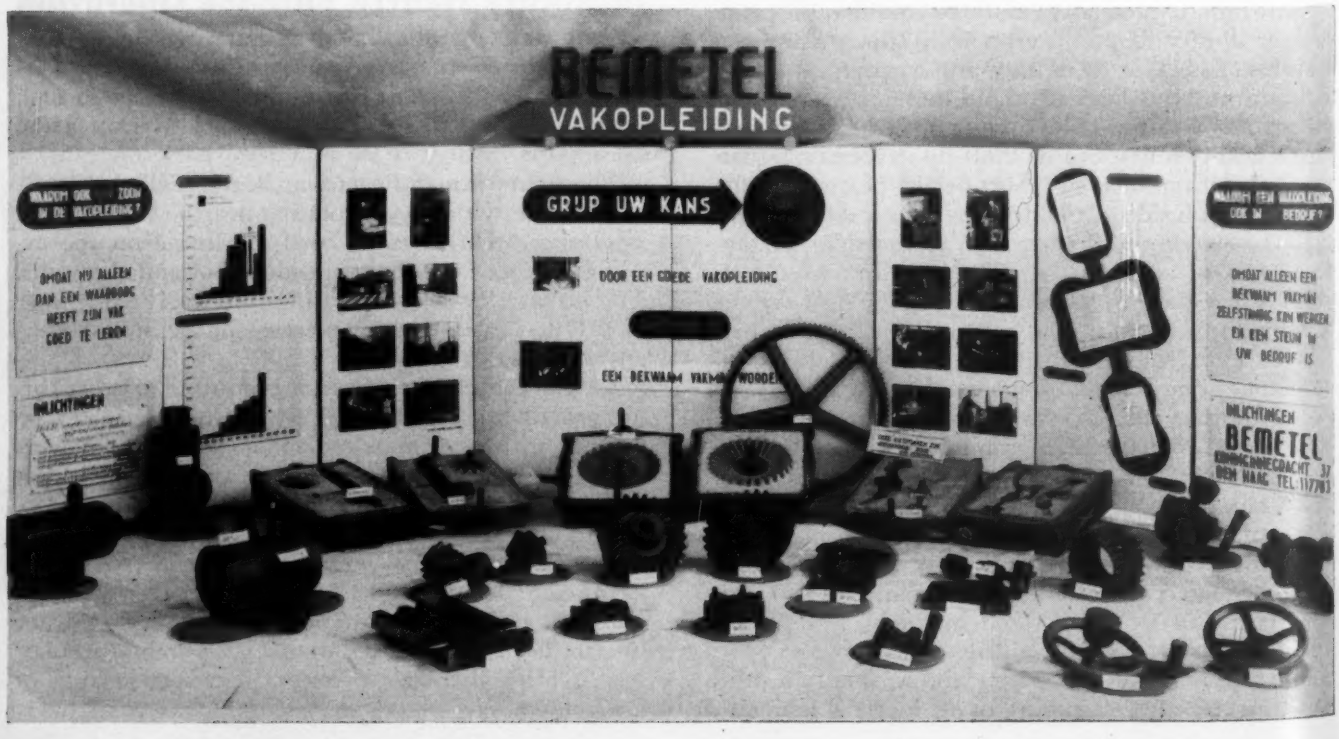
J. H. Ubbink
Managing Director
B. Ubbink & Co.
Doesburg, Netherlands

IN 1946 THE FERROUS FOUNDRIES in Holland produced about 63,000 long tons, and in 1947 production increased about 30 per cent. The Dutch foundry industry (ferrous) comprises 88 foundries—82 cast iron, one tube, four cast steel and one malleable foundry.

Two of the four steel foundries are equipped with electric furnaces as well as open hearths. One foundry uses cupolas for melting and a Bessemer converter, and another foundry uses high-frequency electric furnaces. Total production for the steel foundries is 5,000 long tons per year.

Of the 82 iron foundries, about two thirds are jobbing foundries and the remainder captive foundries.

About 6,000 men are employed in the Dutch foundries, and the average monthly production per man is around 2,400 lb. Only five of the iron foundries produce more than 3,000 tons per year, 20 foundries



A local shop window display of patterns, molds and castings arranged by "Bemetal," the organization of metal-working and electrical industries which sponsors a nationwide vocational training system. The display is intended to interest eligible boys and their parents in the training offered by the industry, and to acquaint local plant management with the advantages of vocational training schools as a source of skilled workers.

more than 1,000 tons per year, and the remaining 57 produce less than 500 tons of castings per year.

Seventy per cent of the total iron casting production is from the 25 foundries producing more than 1,000 tons per year. The 57 foundries producing less than 500 tons per year account for the remaining 30 per cent of the tonnage. Production figures are not available for malleable and cast tube foundries.

Approximately 60 per cent of the cast iron produced is used in machinery castings, 15 per cent for stoves and hearths, 5 per cent for electrical equipment, and 20 per cent in miscellaneous castings.

Equipment

From the foregoing figures it is apparent that the Dutch foundries are not mechanized. Here and there a single roller conveyor is used, but these instances are the rare exceptions.

Those foundries that produce the large castings for engines, up to 50 tons, are well equipped. Some work with sandslingers, and others employ such methods as cement sand molds and sometimes molds completely constructed of cores.

In the foundries producing the smaller castings many molding machines are used. In the Netherlands, proportionately more molding is done with boxes and less with snap flasks than in the United States. As previously mentioned, foundry mechanization, except in the cast tube foundry, is practically nonexistent. However, the principal foundries are working out plans for mechanization as a means of offsetting the present scarcity of labor.

In the iron foundries cupola melting is the general practice, with some use of the Brackelsburg furnace. Electric furnaces are used in producing some of the special irons. Some of the iron foundries are chiefly engaged in producing high tensile strength irons (up to 60,000 psi), mostly cupola melted.

In the matter of foundry sand sources, Holland possesses excellent sand pits. If special sands are wanted, they are available in Belgium and Germany. Synthetic sands are seldom used in Dutch foundries. In the writer's knowledge, only one of the steel casting foundries has applied synthetic sand completely.

Opening of a Dutch vocational school for foundry pupils. Boys of 13 are admitted to the 4-year course, receiving a "certificate of industry" upon completion.

An "oldtimer" is presented with an easy chair, tobacco, and other gifts upon completion of 40 years of service as a patternmaker. Honoring him are his fellow workers and, second from the left, the author, J. H. Ubbink.

Pig iron is supplied mainly by the Royal Dutch Blast Furnaces at Ijmuiden, a large, modern plant equipped with three American blast furnaces. At the time of writing, the metal is pigged in sand molds, but a large pig machine is on order. An excellent grade of foundry coke is produced from coal mined in Dutch mines in South Limberg. Coke is produced in such quantities that a considerable amount is exported.

Blackheart malleable iron is the main product of the one Dutch malleable foundry. As the Netherlands has no automobile and but few agricultural industries, the market for malleable iron castings is quite limited. A foundry for producing whiteheart malleable iron pipe fittings is under construction.

Mechanization Planned

In the matter of quality, it may be said that the castings produced in Netherlands foundries are on a par with world production. On the other hand, Dutch foundries are less efficient than American foundries because they are less highly mechanized. As in other countries, plans are under way for mechanization, especially in the larger foundries. Clean plants and better accommodations will make the foundries more attractive to workers.

In the past, the training of pupils for the molding trade was the "poor relation" in Dutch foundries. Recently, a group of foundries in close proximity has established a school in which the pupils are trained in hand molding. Boys are admitted to the 4-year course at the age of 13 years. Upon completing the course the pupil receives a "certificate of industry."

In the Netherlands, too, the "oldtimers" are held in honor. The accompanying photograph shows the "jubilee" occasion for a patternmaker who has completed 40 years of service.

The writer is not well informed as to the Dutch nonferrous foundries, but there are a great many small foundries and some quite large foundries engaged in producing castings in the copper-base alloys and the light metals. Melting is done in common pot furnaces heated by coke, oil or electricity. These castings are of high quality, equal to the products of other industrial countries.

The Dutch Society of Foundry Technologists, an organization similar to A.F.S., meets twice a year. On these occasions technical subjects are discussed and an excursion made to some plant in the vicinity.

ENGINEERING COMPRESSED AIR INSTALLATIONS TO MEET FOUNDRY NEEDS

IN ORDER TO OBTAIN THE BENEFITS and the advantages of compressed air, planning is essential. To achieve the savings and results expected, care must be exercised in the selection of the equipment, its installation, and in laying out the distribution system. This article will suggest important questions to consider in planning the compressed air plant.

A compressed air plant consists of one or more compressors, each with the necessary driver, control or regulation, intake air filter, aftercooler, air receiver, and interconnecting piping, together with a distribution system to carry the air to points of use.

The object of installing a compressed air plant is to provide a sufficient quantity of air to the work at the pressure required for efficient operation. Before attempting to determine the amount of compressed air necessary, a thorough study should be made to provide for the use of air power in all applications for which it is suitable. The importance of this study in approaching the problem of installing the compressed air plant is obvious since it will anticipate possible future as well as present needs.

The information obtained from the study previously referred to will then become basic in approaching the problem of engineering the compressed air installation in any particular plant. In working out an installation, a series of analyses is recommended. These include: (1) Necessary compressor capacity; (2) number of compressor units; (3) location of compressor units; (4) regulation of compressed air plant; (5) compressed air distribution system.

1. Necessary Compressor Capacity. The proper capacity for an installation is, of course, a vital question, requiring careful analysis. A study of air-operated devices in a typical plant will show that many of these devices operate almost continuously, and others which operate infrequently but require a relatively large air supply when in use. It will also be discovered that the actual amount of air used by the individual device will vary considerably in different applications.

The first suggestion, therefore, is that the average air consumption of air-operated tools be ascertained. This may be obtained from manufacturers' literature or may be closely approximated by actual test. It must not be assumed that all air-operated devices consume the maximum quantity of air under all conditions, as otherwise a false plant size will be developed. Therefore, the load factor must be considered.

NOTE: This paper is based on material contained in the *Compressed Air Handbook*, published by the Compressed Air and Gas Institute, Cleveland.

Relatively few air-powered devices use air continuously. Pneumatic tools of all types operate intermittently, and their net air consumption is considerably less than their maximum. The ratio of actual air consumption is known as the load factor.

Two items are involved in the load factor. The first is the time factor, or the percentage of total time that the device actually uses air. Obviously, if a number of devices are operated from a compressor plant, and none of them operate all the time, it is reasonable to assume, and experience will bear this out, that the maximum air used in cubic feet per minute is much less than the total which would be required if they were all operating at the same instant at full load.

The second item in the term load factor will depend on what might be called the work factor, or the percentage of maximum possible work output per minute which is actually done by the device. For example, the air consumption of a grinder with full open throttle varies considerably, depending upon how hard the operator pushes it against the work. The work factor, therefore, is the ratio of air consumption at the actual conditions of operation to the air consumption when the tool is fully loaded. Actually, the load factor is the product of the time factor and the work factor.

In one shop studied, the actual air consumption was only 15 per cent of the supposed full-time rated air requirements. In a large installation the actual load was only 7.6 per cent of the load which might be expected, based on the total tools in operation, plus stock and reserves. If the air supply had been properly

This compressor plant supplies air power to hundreds of machines and portable tools. Six compressors of the motor-driven reciprocating type range in size from 152 to 800 hp and air output from 600 to 3600 cfm.

(Courtesy of Ferro Machine and Foundry Co., Cleveland)

figured on the tools actually in use, the air required would be 15 per cent of requirements for tools in use.

In determining the load factor, care should be taken to eliminate the tools on hand in the storeroom or not in use. It would be wise to discuss these points in detail with the tool manufacturer before finally deciding on the actual air consumption needed.

The foregoing remarks apply to the more steadily operated air tools and appliances. A study of the uses of air power which cause heavy but usually short-time demands will develop added capacity required for these operations. The possibility of storing air in large receivers should be considered, although this can be helpful only in providing for short-time peak demands.

Some comment should be made on the practice of adding a percentage to calculated compressor capacity to provide for piping leakage. This has been due largely to the fact that compressed air is so harmless that it is not considered vitally necessary for an air system to be tight. Electrical lines must be carefully insulated—leaks cannot be tolerated. Steam lines are kept tight because of danger and also because steam leaks are objectionable. Refrigerating systems must be tight, both because leakage is expensive and the gas is frequently obnoxious.

There is no more justification for allowing compressed air wastage than there would be for installing a compressor with capacity controls and permitting it to operate continuously at full capacity, discharging the surplus to the atmosphere through relief valves.

Previously, it has been customary to add an arbitrary item of about 10 per cent for leakage. Compare this to an acceptable limit in the fuel gas distribution field of less than one cfm per mile of 3-in. line. Air lines can be made just as tight as other piping systems and can be kept tight. It pays to do so.

Provide for Growth

Before determining the final compressor capacity, consider carefully that once compressed air is available its versatility will of itself lead to a magnitude of profitable uses and applications not originally anticipated. Although mechanically it is not difficult to increase the size of a compressed air plant, since any number of units can discharge into the same system, it is prudent to provide some excess capacity for growth when the plant size is originally considered, including the piping system. What this excess capacity for future growth should be will depend largely upon individual conditions and total known requirements.

It is less difficult to arrive at the proper capacity needed for a plant extension than for a new installation. Local experience, compressor load factors, tool load factors, etc., either known or readily determined, provide a sound basis for decision.

The most frequent indication that additional compressor capacity may be needed for an "overloaded" plant is low air pressure, which reduces shop production alarmingly. This condition will be discussed later in the paper.

Based on a careful log of the pressures throughout the production areas, present compressor operating load factors and peaks in demand (periods of unusually low air pressure), it is possible to determine with reasonable accuracy the additional compressor capacity required to maintain full air pressure at the working positions and thus increase tool effectiveness and production to the maximum. In all calculations compressed air measurements should be in terms of cubic feet per minute of actual free air.

Small two-stage air-cooled compressor complete with driver, filter, pipe-line type aftercooler and receiver.

2. Number of Compressor Units: An important factor is the number of units into which total capacity should be divided. Air compressors are sturdy machines but, like all mechanical and electrical equipment, they require maintenance and occasionally must be taken out of service. Provision for compressed air supply during maintenance periods is handled differently in almost every plant. If the supply of compressed air is vital to continued production, the answer usually is determined by a comparison of the cost of stand-by capacity with the value of the production loss.

Many plants require a relatively small volume of air continuously, even when the plant is not in production. A small unit of proper size to take care of such requirements over week ends and holidays often is desirable and efficient. Examples of such requirements are dry pipe sprinkler systems, oil burners on furnaces which must be kept hot overnight or week end; and air supply for tools used by plant maintenance crews over week ends.

3. Location of Compressor Units: The location of a compressed air plant with relation to the points of air use should be given some study. A central plant housing all of the compressors involved has advantages in unified operation and care, better supervision, and probably less labor cost. In a central plant, it is probable that no more compressors will be kept in operation than are necessary to maintain pressure. Therefore, the load factor and operating efficiency of each unit will tend to be relatively high.

Locating Multiple Units

It is possible, however, that a central plant cannot be so located that satisfactory distribution of air and maintenance of pressures may be obtained without excessive piping costs. In such cases, it may be better to divide the compressor plant into two or more installations at or near specific load centers, interconnecting the plant piping so that air may be distributed either way to meet peak load requirements. Of course, the compressor plant should be placed as close as possible to the larger load centers. This reduces piping costs and results in higher air pressures at the tools.

Core blowing is another application of compressed air in the foundry. The core box shown is being cleaned with an air stream, the operation requiring 4 to 6 cu ft of air per box. Blowing the core (approximately 5 lb of sand) for a motor head casting requires 3 sec.

Where two or more compressors are installed in various parts of the plant, the equipment should not be placed in some obscure corner with no one to look after it. Such an installation will surely be neglected, with costly consequences.

4. Regulation of Compressed Air Plants: Since the demand for compressed air usually varies widely from time to time, some form of capacity control is required. Two general methods are available. The first, known as speed and pressure regulation, varies the speed of the compressor according to the demand for air, such as usually is the practice in a steam-driven compressor. The second, known as constant speed regulation, operates the compressor at a constant speed and varies the capacity by any one of several types of unloading systems, as is practiced in motor-driven compressors.

For general industrial use, control of pressure closer than a 5 per cent range between full load and no load is unnecessary and should be avoided. Much closer regulation of the pressure can be provided where special conditions require it.

Wherever possible, pressure regulators should be so selected and adjusted that large units will act as base-load units, and unload only after smaller units have been shut down. Of course, where the requirements have diminished to the capacity of one of the smaller units, the large unit should be shut down. In this way, the overall economy will be improved.

5. Compressed Air Distribution System: Any drop in pressure between the compressor and the point of use of the compressed air is an irrecoverable loss. The distribution system is, therefore, one of the most important elements of the compressed air plant. In planning it, the following general rules should be observed:

1. Pipe sizes should be sufficiently large that the pressure drop between the receiver and the point of use will not exceed 10 per cent of the initial pressure. Provision should be made not only for present air capacity but also for reasonable future growth.

2. Where possible, a loop system around the plant and within each shop and building should be used. This will provide a two-way distribution to the point where the air demand is greatest.

3. Long distribution lines should have receivers of liberal size located near the far ends or at the points of occasional heavy use. Many peak demands for compressed air are instantaneous or relatively short, and storage capacity prevents excessive drop.

4. Frequent outlets should be provided on each header or main for attaching hose for air-operated equipment, the outlet always being placed at the top of the pipe line to prevent carry-over of condensed moisture to the tool. Frequent outlets result in shorter hose length and less pressure drop through the hose.

5. All piping should be arranged so that it slopes toward a drop leg or moisture trap in order that condensed moisture may be removed from the piping system, preventing it from being carried over into the air tools or air-operated devices.

In planning the distribution system, it should be remembered that oversize piping costs but little more than the smaller size because most of the initial expense is for labor.

Type of Compressor: Following the five analyses and thorough consideration of the data obtained, the selection of the particular type of compressor—reciprocating, rotary or centrifugal—should be based on consultation with various manufacturers, whose engineers are best qualified to make such recommendations.

Before finally determining the precise type of compressor to be installed, consideration should also be given to the various types of power used to drive compressors—electricity, steam, oil, gas or gasoline. The type of drive deserves careful study from the standpoint of first cost, operating cost, reliability of power or fuel supply and maintenance. Occasionally, the anticipated plant load factor will have a bearing on the selection.

The foregoing discussion has been in the general nature of an outline. The following part of this paper will consider a costly and wasteful practice which should not be tolerated—low air pressure. Causes, effects and remedies of this abuse will be covered.

Low Air Pressure—Causes, Effects, Remedies

By "low air pressure" is meant inadequate pressure at the tool or the device which is air-operated. It is at this point that the air is used as power. Only the pressure and volume of air available at the point of use can be effective in doing work. Most pneumatic tools, for example, are designed to operate at 90 lb gauge maximum at the tool. This means pressure at the point where the air enters the tool while the tool is in operation. If the pressure is below the range of 85- to 90-lb gauge, then it should be considered too low since it reduces the ability of the tool to do the amount of work for which it was designed.

The causes of low air pressure are easily classified: (1) Insufficient compressor capacity; (2) inadequate piping; (3) leakage.

When it is discovered that pressure is too low, the first inclination is to install more compressor capacity. That it not necessarily the correct answer. It should

first be determined whether the compressors are at full load when the air pressure is low. If they are, then more compressor capacity may be required but, even then, consideration must first be given to two other common causes of low air pressure.

The second cause of low pressure is inadequate piping. A measure of the adequacy of piping is the pressure loss between the air receiver, where the compressor endeavors to maintain a constant pressure, and the point of use. This should not exceed 10 per cent in a well-designed system. The absolute maximum drop for the worst point in the system should not exceed 15 per cent. If the pressure drop is greater than 10 per cent average, 15 per cent maximum, throughout the entire distribution system (including hose), then attention should be given to correction of this fault before considering increased compressor capacity.

A third cause of low air pressure is leakage or loss of air. It has been pointed out that permitting excessive leakage is the same as exhausting the output of a compressor directly to the atmosphere. Obviously, if leakage is eliminated, the compressed air formerly wasted will be available for useful work. The expense of making lines tight will undoubtedly be less than the installed cost of a new compressor.

Increase Air Pressure and Production

There are few uses of compressed air which are not vitally influenced by low air pressure. All portable pneumatic tools, rock drills, concrete breakers, hoists, scrapers, loaders, all pneumatic transfer and conveyor systems, paint sprays, oil burners, sandblasts, air lift pumps, etc., operate less effectively when the proper air pressure is not maintained.

The positive results of increasing air pressure to the proper value are: (1) Increased production; (2) reduced cost per unit produced.

The economic advantages of increased air pressure (or conversely, the losses due to low pressure) can be nicely illustrated by considering portable pneumatic tools. For example, an average increase of 37 per cent in production can be obtained for about 30 per cent increase in air consumption by increasing the air pressure at the tools from 70 to 90 lb.

Consider an installation of 20 tools operating from an $8500.00 compressor plant, first at 70-lb and then at 90-lb gauge pressure. With power at one cent per kilowatt-hour, fixed charges at 15 per cent of installed cost, plus labor and supplies, air at 100-lb pressure cost five cents per 1000 cu ft.

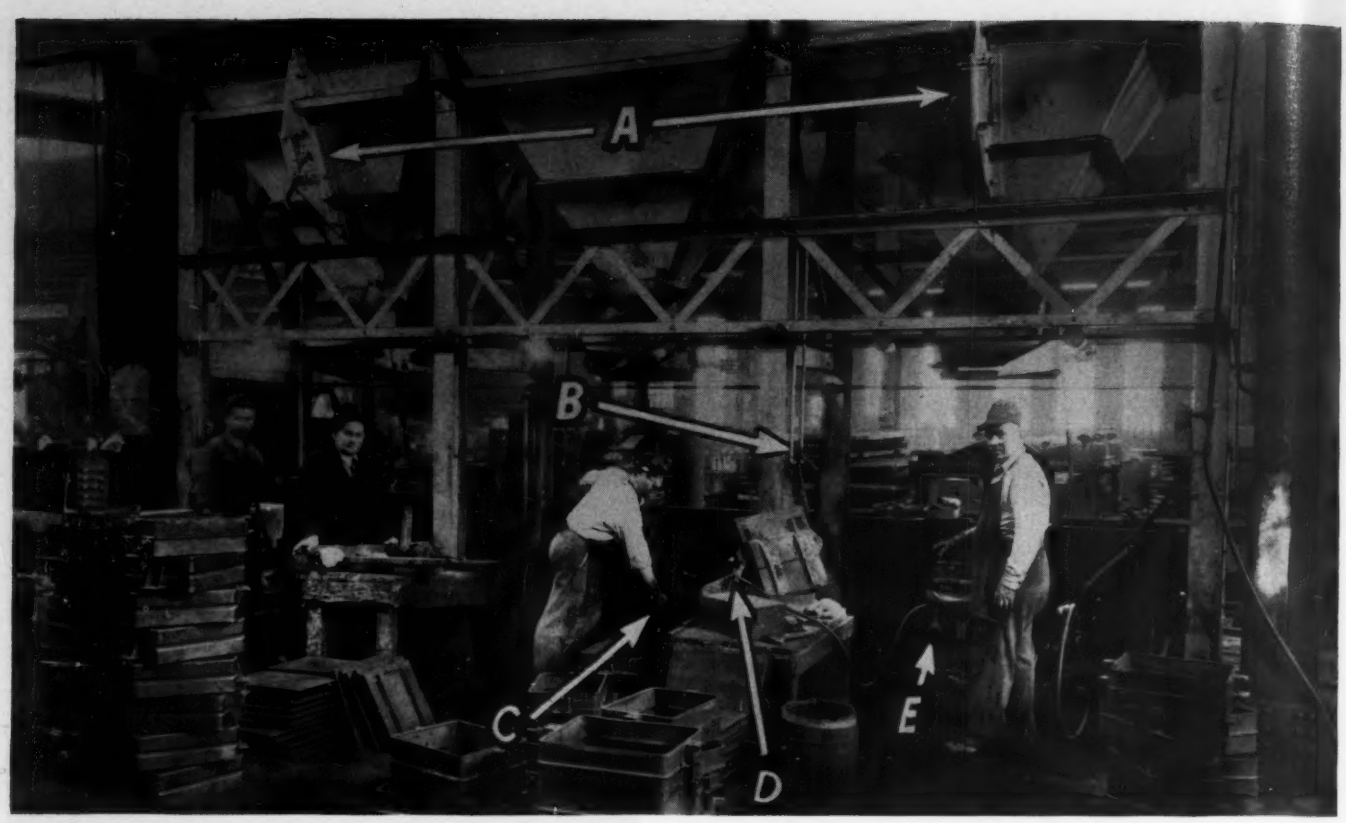
The following tabulation brings out pertinent data:

Operating air pressure at compressor	100 lb	100 lb
Operating air pressure at tools	70 lb	90 lb
Tool load factor	33%	33%
CFM required per tool at maximum load	50	68
Number of men and tools	20	20
Total CFM used	333	453
Total cu ft used per 8-hr day	160,000	217,600
Cost of air per 1000 cu ft	$ 0.05	$ 0.05
Cost of air per day	8.00	10.88
Increased air cost	—	2.88
Labor rate per 8-hr day (incl. burden)	16.00	16.00
Total labor cost per day	320.00	320.00
Total cost per day	328.00	330.88
Ratio of air cost to total cost	2.4%	3.3%

Assuming that only one third of the 37 per cent increase in tool productivity can be translated into labor productivity, it is evident that 12 per cent more actual work will be accomplished with 90-lb gauge air pressure than with 70-lb gauge air pressure. The work previously done for $328.00 can now be done in less time and will reduce the cost to $330.88 divided by 1.12, or $294.71. Thus, even though air costs are increased, there is a net saving through the increased production of $33.29 per day, or about $8500.00 per year (equal to the first cost of the compressor plant).

Analyzing this another way, when the pressure is

An interesting adaptation of an air hoist is its use in moving large flask molds along a roller conveyor. The hoist is mounted horizontally under the rollers. A dog, mounted on the cylinder pistons, contacts the flasks at the end of the line and pushes them about 10 ft to the pouring station. On the return stroke of the piston the dog drops into the center opening of the split conveyor, passing underneath the flasks until the piston reaches the limit of its stroke, when it again rises to contact the next group of flasks on the conveyor line.



This foundry makes extensive use of compressed-air-operated equipment, including: (A) Air-driven bin vibrators; (B) valve controlling the vibrators shown in (A); (C) valve for operating squeezer; (D) vibrator for removing cores from boxes; (E) valve for operating jolt.

increased to 90-lb gauge, the tools require 120 cfm more air. A compressor with motor and auxiliary equipment to supply about this amount of air would cost $2200.00. The saving of $33.29 per day would pay for this new unit in 68 working days, less than 3 months.

When the question of purchasing additional compressor capacity arises, as opposed to making other arrangements for the operations involved in a shop, it should be remembered that adding to compressor plant capacity frequently affords protection for many vital shop operations other than the operation of pneumatic tools. Among these are sandblasting, paint spraying, hoisting, agitating of liquids, air jet vacuum equipment for cleaning foundry sand, operating controls in power plants, air chucks in a machine shop, safety devices on punch presses, air jets for ejecting parts from presses, cleaning molds, patterns, coreboxes, etc.

Plan Adequate System

Remedies for low air pressure are just as definite as the causes and effects. Faulty air power conditions usually are due to poor planning or to increased air uses without corresponding system expansion. Plant-wide analysis should determine the full extent of low air pressure and the present air flow requirements. Future growth must also be considered.

Pressure loss varies roughly as the square of the velocity of air flowing through the pipe. For example, a 3-in. line, 1000 ft long, will handle 500 cfm with a 2.5 lb pressure loss, while a 4-in. line will pass about 1000 cfm with the same pressure drop. The installed cost of the 4-in. line, however, will be very little more than that of the 3-in. line, since most of the cost of the distribution system is for labor in the installation.

Methods of increasing pipe line capacity to decrease pressure loss and improve conditions at the point of use vary with different installations. One method may call for a line paralleling the original, with frequent interconnections; another may require installation of a loop system with some outlets taken off the new line to relieve the old; still another may need a complete new system. Branch lines and manifolds for attachment of tools, etc., should be planned "oversize."

Not the least of the problems of correct system layout is the selection of proper hose for final transmission of compressed air to the tool. Losses of 15 to 25 per cent in air pressure are frequent in the hose alone. The length of hose should not be greater than that necessary to make the tool available to the work and allow proper freedom of movement to the operator.

Every cubic foot of leakage eliminated is pure gain. Such losses in many systems will reach 10 to 20 per cent of the total air compressed. An air leakage test should be run on the complete plant and every section of hose should be inspected. Although leaks usually are small they may be numerous, with a high total effect. A single $\frac{1}{16}$-in. hole will waste 182,000 cu ft per month at a cost of $9.10.

Small leaks are most likely to occur around valve stems, in hose connections, unions, drains, homemade blow guns, and lines leading to inoperative tools. Elimination of leakage involves making the system tight, and then keeping it tight. Regular inspection of the system is mandatory.

Only after it has been determined that the distribution system is adequate and that leakage has been eliminated should an increase in compressor capacity be considered to care for plant requirements.

CENTRIFUGAL CASTING

Calculations and Feeding Pressures

W. A. Spindler
Assistant Professor
University of Michigan
Ann Arbor

ALTHOUGH NUMEROUS AUTHORS have presented mathematical formulas that apply to various phases of centrifugal casting, none of these writers has given the fundamental derivation of their equations. It is the purpose of this article to so derive the simplest of these equations that the engineering student of the subject can grasp the fundamental points involved. In addition to clarifying the mathematics of the process, the three active feeding pressures are examined relatively in the following discussion, and centrifugal casting speeds are considered.

The derivation of the equation for centrifugal pressure at any point within a rotating mass of molten metal is made most general by assuming a true-centrifugal casting that has an internal radius r_i, a partial cross section of which is shown in the sketch. It is desired to derive the equation for the centrifugal pressure, in psi, within the molten casting at any distance r from the center of rotation.

The basic equation for the centrifugal force is

$$\text{(1)} \qquad CF = m\omega^2 r$$

where m is the mass in pounds, ω is the angular velocity in radians per second, and r is the radius.

In the calculation of the centrifugal pressure at distance r from the center, the column of molten metal (xy, Fig. 1), that is exerting this pressure can be assumed to have a uniform cross section of one inch square, since fluid pressure is independent of area and can be considered as acting at a point on the surface at y. The force acting on unit area at y is due to the circular motion of the column of metal xy which is made up of an infinite number of increments Δr.

If the mass in equation (1) is taken as the density of the molten metal in pounds per cubic inch, the mass of each increment in the column of metal in Fig. 1 is mdr. Since the centrifugal force exerted by these increments of mass is proportional to their distances from the center, the total force per unit area, or centrifugal pressure, at a point distant r from the center is

$$\text{(2)} \qquad CP = \int_{r_i}^{r} (mdr)\ \omega^2\, r = \int_{r_i}^{r} m\omega^2 r dr$$

Equation (2) will now be used to calculate the centrifugal pressure at the outer surface of a semicentrifugal gear casting, 24 in. in diameter, that is rotating at 100 rpm with axis vertical and a central riser for feeding. When filled with molten steel having a density of 0.28 lb per cu. in., the centrifugal pressure at the periphery of this gear blank is

$$CP = \int_{r_i}^{r} m\omega^2 r dr = m\omega^2 \frac{(r^2 - r_i^2)}{2}$$

$$= \frac{0.28}{32.2 \times 12}\left(\frac{2\pi\ 100}{60}\right)^2 \frac{(\overline{12}^2 - \overline{0}^2)}{2}$$

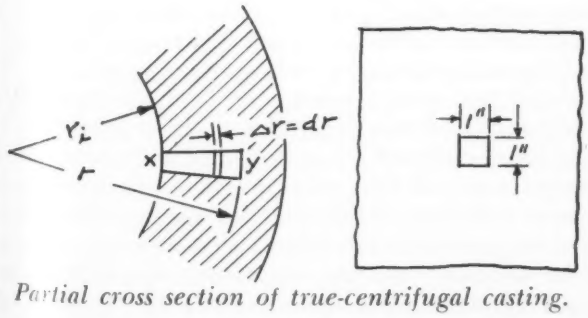
$$= 5.7 \text{ psi}$$

The factor 32.2 in this equation is the acceleration due to gravity in feet per second that is needed to change the result from poundals to pounds; the factor 12 converts feet to inches; and the factor 60 changes radians per minute to radians per second.

In addition to the 5.7 psi centrifugal pressure, calculated in the foregoing, there is a static feeding pressure owing to the height of the riser and the thickness of the casting. Assuming that this static head is 8 in. of molten metal, the static feeding pressure then would be $8 \times 0.28 = 2.24$ psi.

Furthermore, atmospheric pressure of 14.7 psi acts through the molten riser to feed the casting as soon as a skin of metal has solidified within the mold. Therefore, the total feeding pressure toward the outer layers of the rotating casting is $5.7 + 2.2 + 14.7 = 22.6$ psi. It is of interest to note that in semicentrifugal casting practice in which the peripheral speeds are usually between 200 and 1000 fpm, atmospheric pressure remains the greatest feeding pressure, as in most static castings.

In true-centrifugal casting of pipe and hollow cylindrical parts the mold is usually rotated at a speed that produces a centrifugal force of 75 times gravity force, or 75G, at the internal radius of the casting. The meaning of this conventional manner of stating rotational speed is most simply explained by calculating



Partial cross section of true-centrifugal casting.

the rpm that a 6-in. inside-diameter pipe would have to be rotated to secure 75G centrifugal force, as follows:

$$75 = m\omega^2 r$$

$$= \frac{1}{32.2 \times 12}\left(\frac{2\pi \text{ rpm}}{60}\right)^2 \quad (3)$$

Solution of this equation for rpm gives a value of 939, which means that a mass of one pound must be rotated at 939 rpm at a radius of 3 in. to produce a centrifugal force of 75 lb, or 75 times its weight due to gravitational force.

Mold speeds that provide 75 times gravity force at the internal radius are ordinarily required in sand-lined molds to hold the molten metal against the mold when the axis of rotation is horizontal. In metal molds, however, speeds that develop 60G force suffice, owing to the more rapid solidification and adherence of the metal to the mold. When the axis of rotation is in the vertical position, 100G is required to minimize the taper from top to bottom of the internal diameter of the casting.

Speeds that produce centrifugal forces much in excess of 100G are not considered to be safe due to the high stresses that are developed in the casting machine and in the casting itself. Consequently, when making thick-walled castings speeds are used that will produce forces not much in excess of 100G at the outside radius, and not less than 60G internally.

The centrifugal feeding pressure that is developed at any point within the molten metal of a true-centrifugal casting can be calculated by using equation (2). This pressure in the outer layers of a steel casting having an outer diameter of 12 in. and an inner diameter of 6 in., while rotating at 800 rpm, is as follows:

$$CP = \frac{0.28}{32.2 \times 12}\left(\frac{2\pi\ 800}{60}\right)^2 \frac{(\bar{6}^2 - \bar{3}^2)}{2}$$

$$= 68.6 \text{ psi}$$

When this pressure is compared with the 22.6 psi pressure calculated previously for semicentrifugal castings, it is apparent that the higher speeds of rotation used in true-centrifugal casting operations develop much higher feeding pressures.

The more complex equations for calculating the internal taper of true-centrifugal castings made with the axis of rotation in the vertical or inclined positions are given in the following references:

1. F. G. Carrington, TRANSACTIONS, American Foundrymen Association, vol. 52, p. 333 (1944).
2. J. E. Hurst, *The Foundry*, May, 1945, p. 105.

NON-FERROUS CASTING GRINDING PRACTICE

GRINDING IS DONE ON CASTINGS made from all types of non-ferrous alloys for the purpose of removing fins, gates, and risers, using essentially the same procedure as employed on gray iron, malleable iron, and steel castings. However, non-ferrous castings are usually lighter and smaller and do not require the heavier types of grinding equipment. Small double end floor-stand grinders mounting wheels 8 to 18 in. in diameter are most generally used.

The larger, light-metal castings, too heavy or unwieldy for the stand grinders, are usually ground with portable grinders. Some of the very large and heavy brass and bronze castings lend themselves to grinding with swing frame grinders.

When polishing and buffing non-ferrous castings, rough grinding marks can be removed and a satin finish obtained with set-up polishing wheels. Castings are first rough polished on dry, stitched canvas polishing wheels coated with 60 to 80 aluminum oxide grain. This is followed by a second operation with wheels set up with 120 to 180 aluminum oxide grain. Grease is used on these second stage wheels; a tallow stick is the lubricating medium most generally used. The work is then buffed on a closely stitched cloth wheel, using a greaseless compound containing a fine abrasive.

The polishing of magnesium castings requires precautions similar to those taken in snagging operations. Care should be taken not to allow dust to settle on workmen's clothing, window sills, or work benches because of high inflammability of magnesium dust. The same type of dust collectors should be used in polishing as in the snagging operation described below.

Speeds of grinding wheels for use in non-ferrous foundries should not exceed 6500 surface fpm for vitrified bonded wheels or 9500 surface fpm for resinoid grinding wheels. Abrasive grit sizes from 20 to 36, combined with a medium structure and medium to hard grades, are most suitable for grinding these metals. The abrasive should be of the silicon carbide type rather than the aluminum oxide type. Aluminum oxide abrasive is, however, satisfactory for use on very hard bronze castings such as are used for machine bearings.

Grinding wheels for magnesium alloys should be plainly marked *For Magnesium Only*. A close watch should be kept for iron inserts, core wires, and other material that can cause sparks in grinding.

In choosing grain sizes it is well to remember that coarser grit wheels bite into the work so that extra effort is required by the operators to slide the wheel from one place to the other on the castings. Also, the coarse grit wheels are apt to leave deep scratches on soft metal. Grain sizes finer than 24 are preferred for portable wheels.

Floorstand grinders work best with 20 grit. On swing frame operations, 16 grit wheels are recommended because of their rapid stock removing ability. Castings rough snagged with frame machines can be further cleaned and smoothed with portable grinders.

A new treatment now available replaces grease sticks in retarding wheel loading. The treatment medium penetrates the whole structure of the wheel and upon melting at the normal grinding temperature coats the abrasive grains and bond, thereby retarding wheel loading. No other wheel lubrication is required.

In controlling dust, standard dust collectors used in ferrous foundries have also proved satisfactory in non-ferrous foundries. However, the magnesium foundry cleaning room requires special precautionary measures to be taken to prevent explosions and fires. When grinding magnesium the machines are usually connected with individual dust collectors.

Condensed from an article by A. E. Wilson, Norton Co., Worcester, Mass., entitled "Grinding Practice in Non-Ferrous Foundries" in the May issue of Norton's *Grits and Grinds*.

A.F.S. Technical Papers Featured At Annual Conference Of IBF In London

THE 45TH ANNUAL CONFERENCE of the Institute of British Foundrymen, held in London, June 8-11, featured, in addition to the regular technical programs, the Annual Banquet, at which the Institute's Gold Medals were awarded, announcement of the election of R. B. Templeton, managing director of the Ealing Park Foundry, Ltd., London, as 1948-49 president of the Institute, and visits to a number of foundries in the London area.

Numbered among the distinguished visitors at the Conference were Sir William Reid Dick, designer of the memorial statue to the late President Roosevelt, which now stands in Grosvenor Square, London, as a tribute to America's war effort; Lord Llewellyn, wartime Civil Lord of the Admiralty and Minister of Aircraft Production; and the Conference's guest of honor, British Minister of Supply G. R. Strauss.

Technical papers by two members of the American Foundrymen's Society were a feature of the regular sessions. Selected to deliver the annual Edward Williams Lecture, one of the highlights of the Conference, Dr. Harry Schwartz, National Malleable & Steel Castings Co., Cleveland, Ohio, was unable to attend. Instead his address on *"Some Solved and Unsolved Problems in the Metallurgy of Blackheart Malleable"* was present by A. E. Peace, chief metallurgist, Lay's Malleable Castings Co., Ltd., Derby.

The Exchange Paper of the American Foundrymen's Society, *"Do You Use Your Cost System?"*, was presented by Ralph L. Lee, Grede Foundries, Inc., Milwaukee, Wis., chairman of the A.F.S. Foundry Cost Committee. Exchange papers from the Association Technique de Fonderie de Belgique and the Association Technique de Fonderie de France were also featured on the program.

"Nodular Cast Irons, Their Production and Prospects," by Henton Morrogh and J. W. Grant of the British Cast Iron Research Association, described the revolutionary developments in the production of cast irons by treatment with cerium metal outlined by Mr. Morrogh in a paper presented at the 52nd Annual Foundry Congress of the A.F.S.

"Problems of Contraction and Distortion in Cast Iron Castings," E. Longden, P. R. Jackson & Co., Ltd., Salford, also presented at this year's Foundry Congress was another outstanding Conference paper.

The three-day Conference opened with the Annual General Meeting, in which three awards were presented to IBF members. J. G. Pearce was awarded the E. J. Fox Gold Medal in recognition of his many years of service to the foundry industry as director of the British Cast Iron Research Association. The Oliver Stubbs Gold Medal was awarded L. W. Bolton, Morris Motors, Ltd., Wellingborough, for his outstanding services on the Technical Council of Committees of the Institute and for his contributions to the knowledge of founding as the author of many papers. C. Lashly received the Meritorius Services Medal for his services as honorary secretary of the Newcastle branch of the IBF for many years. J. J. Sheehan, Coneygre Foundry, Tipton, was nominated a junior vice president of the IBF for 1948-49, and N. P. Newman, managing director, Newman, Hendler & Co., Ltd., senior vice-president.

Other featured papers of the Conference were:

"Refractory Materials in the Foundry Industry," A. T. Green, director, British Refractories Research Association.

"Steel Casting Cleaning Methods," A. B. Lloyd, F. H. Lloyd & Co., Ltd., Wednesbury.

"Gas Porosity in Nickel-Silver Castings," W. A. Baker, senior metallurgist, British Non-Ferrous Metals Research Association.

"New Ladle Methods of Desulphurizing Pig Iron," Dr. W. C. Newell, A. J. Langner, and J. W. Parsons, British Iron and Steel Research Association.

"Plastic Flow in Cast Iron at Room and Elevated Temperatures, with Special Reference to the Relief of Stress," C. R. Tottle, lecturer in metallurgy to the University of Durham, Newcastle-upon-Tyne.

"The Maurer Diagram and its Modifications," Exchange Paper from the Association Technique de Fonderie de France, by H. M. LaPlanche, metallurgist.

"A Study of the Residual Gases in Cast Iron," Ralph V. Riley, chief research metallurgist, and Dr. J. E. Hurst, research manager, Bradley & Foster, Ltd.

"Some Fundamental Problems in Foundry Planning," Jorgen Drachmann, technical director A/B Svenska Strebelverken and A/B Svenska Centrifugalror, Sweden.

A corollary Ladies' Entertainment Program, running the full three days, included a performance of the American musical comedy, "Oklahoma!" at London's Drury Lane Theater Royal, a visit to the Royal Academy, a river steamer trip to Kew Gardens and a tour of one of London's large department stores.

Foundry Papers Dominate Congress Of Brazilian Society For Metals

MOST OF THE PAPERS presented at the fourth annual congress of the Brazilian Society for Metals, held in Rio de Janeiro May 31-June 5, dealt with foundry practice. In addition to the usual technical sessions there were visits to a munitions factory, a General Electric plant, and an airplane engine factory. The annual dinner was held at Quitandinha in Petropolis.

Papers of particular interest to foundrymen included two on melting iron in the cupola, one on melting in the induction furnace, and one on basic electric furnace production of manganese steel. A session devoted to management problems covered pricing of patterns, a study of semi-mechanized foundries, and organization of a foundry.

Molding sands, core baking, and foundry applications of plastics were the subjects of papers presented at one of the sessions. Another session offered papers on gas problems of bronzes, gamma ray inspection, and quality control of patterns.

First Postwar International Foundry Congress To Be Held In September

THE FIRST POSTWAR International Foundry Congress, to be held in Prague, Czechoslovakia, September 20-26, will stress four principal phases of foundry operation—metallurgical processes, special foundry techniques, design of castings from the point of view of the founder, and testing of materials. An international Foundry

Exhibition will run concurrently with the Congress.

The first part of the Congress will take place in Prague and will last five days. During this time, excursions will be organized to important foundry installations in the Prague area, in addition to the regular program of technical meetings. The second part will be devoted to a trip across Czechoslovakia, lasting about a week, and will include visitations to the most important industrial centers and a trip to the Prague Autumn Fair.

Technical papers by Czechoslovakian foundrymen scheduled to date include:

"Czechoslovak Foundry Industry," Dr. A. M. Plesinger.

"High Frequency Induction Furnaces in Operation," J. Zampach and J. Mackievic.

"Low Frequency Induction Furnaces in Founding Gray Cast Iron," V. Uxa.

"Malleable Cast Iron Produced in High-Frequency Furnaces," A. Cihak.

"Exploitation of Atmospheric Pressure in Manufacture of Steel Castings," J. Kraus.

"Centrifugal Casting of Tools," J. Doskar.

"Experience with Mechanization of Steel Foundries," Richter.

"Cooperation of Designer and Foreman in Steel Casting," Janousek and Pribyl.

"Pressure Die Casting in Czechoslovakia," M. Hajek.

"Machining of Castings by Spark Discharge," J. Chudoba.

"Utilization of Ultra-Sounds in Foundries," Dr. K. Ryksa.

"Recruiting and Training of Personnel for Foundries," V. Oliverius.

"History of Czechoslovak Founding," A. Habart.

"Spectrographic Analysis of Brass and Copper," T. Jelinek.

"Centrifugal Casting of Ingots of Aluminum and Copper Alloys for the Production of Metallurgic Semiproducts," F. Kralik.

"Fatigue of Castings—Especially of Gray Iron," Dr. O. Puchner.

Malleable Founders Society Elects Officers, Directors At Annual Meet

THE MALLEABLE FOUNDERS' SOCIETY'S Annual Meeting, held June 10 and 11 at the Homestead, Hot Springs, Va., included committee meetings, presentation of the new managing director, Lowell D. Ryan, announcement of officers and directors for 1949 and the presentation of the McCrea Medal at the Annual Dinner. The meeting was attended by 113 members of the Society and their families.

W. H. Moriarty, National Malleable & Steel Castings Co., presided at the Thursday sessions, which started with the President's report and included reports of the Treasurer, the committees on Publicity, Government Relations and Controls.

At the Annual Dinner, held Thursday evening, Robert L. Fauntleroy, president, Moline Malleable Iron Co., St. Charles, Ill., was awarded the McCrea Medal for his long and outstanding record of service to the industry as president of the Institute and the Society, and as a director and committee chairman.

Friday's meeting, under the chairmanship of 1948-49 President C. L. Carter, Albion Malleable Iron Co., Albion, Mich., opened with reports by the Plant Operations Committee, the Research and Product Improvement Committee, the Cost Accounting Committee, the Membership Committee, the Program Committee, the Educational Committee and the Committee on Investments and Budgets.

A report presented by the Society's Consulting Engineer, "Some Items of Metallurgical and Operational Interest," illustrated the effects of surface finish, anneal and analysis with charts. The effect of shrink, primary graphite and design were discussed and illustrative examples were shown.

George D. Branston's report on his trip to Europe indicated he did not foresee any substantial flow of scrap to the United States in the near future.

The officers and directors of the Society for 1948-49 were announced as follows:

President, C. L. Carter, Albion Malleable Iron Co.

Vice-President, J. H. Smith, Central Foundry Division, General Motors Corp.

Managing Director, Lowell D. Ryan (see Foundry Personalities, page 70).

Technical and Research Director, James H. Lansing.

Directors: H. N. Albright, Columbia Malleable Castings Corp.; F. D. Brisse, Laconia Malleable Iron Co.; C. L. Carter; R. N. Cole, Canton Malleable Iron Co.; C. A. Gutekunst, Jr., Milwaukee Malleable & Grey Iron Works; H. M. Laws, New Haven Malleable Iron Co.; J. T. Llewelyn, II, Chicago Malleable Castings Co.; W. H. Moriarty; F. O. Parker, Dayton Malleable Iron Co.; F. E. Shumann, Lehigh Foundries, Inc.; J. H. Smith, General Motors Corp.; and John A. Wagner, Wagner Malleable Iron Co.

Gray Iron Founders' Society Forms Technical, Organizational Programs

FORMATION OF A TECHNICAL PROGRAM and the organization of local management groups to participate in long-range plans for the improvement of products and market expansion, are reported by the Gray Iron Founders' Society.

The Society's technical committee has approved a proposal that authors be urged to submit worthwhile technical papers to the American Foundrymen's Society for presentation at the A.F.S. Annual Foundry Congress, and has pledged its cooperation in the organization of a Gray Iron Round Table Luncheon at the 1949 A.F.S. Foundry Congress, to be held in St. Louis, May 2 to 5.

The Society has selected C. O. Burgess (see Foundry Personalities, page 71) as technical director and has scheduled activities which will comprise publication of a *Gray Iron Products Handbook,* preparation of articles on gray iron for magazines serving the metals fields, a consultation service to members, and improvements of gray iron specifications.

It was also announced that gray iron foundry executives throughout the nation are organizing local and regional management groups, to be largely autonomous and headed by their own chairmen, to complement the work of the Society. When the organizational phase is completed, there will be 40 such groups throughout the United States.

According to Society officials, the group organiza-

tional plan is the only way in which the Society's administrative plans can be met effectively.

Benefits of the local group plan are that it enables foundrymen to meet frequently without traveling great distances; that it permits discussion of state and local problems with which the Society does not deal; that it furthers study of Society activities and cooperation with its headquarters on industry-wide projects; and that it encourages group recommendations for consideration by the Society.

Groups have already been established in Pittsburgh, St. Louis, Metropolitan New York, Northern New Jersey, Northern Ohio; Rochester, N. Y.; Quad Cities (Iowa), Omaha, Minneapolis, Milwaukee, Northern Indiana, New England, and the Philadelphia-Reading area, with others in the process of formation.

International Chemistry Congress To Be Held In Belgium September 11

THE 21ST INTERNATIONAL CONGRESS of Industrial Chemistry will be held in Brussels, Belgium, from September 11 to 19. The Federation of Chemical Industries of Belgium will act as host to the Congress, which will be composed of seven major technical groups as follows: Group I—Organization of Factory and Laboratory; Group II—Fuels; Group III—Mineral and Metallurgical Industries, will include sessions on minerals, metallurgy, siderurgy, non-ferrous metallurgy, electrometallurgy, chemical mineral industry, rare earths, radioactive bodies, electrochemistry.

Group IV—Materials of Construction; Group V—Organic Industries; Group VI—Food and Agricultural Industries; Group VII—Industrial Organization, will include sessions on scientific organization of research and instruction, patents, bibliography, hygiene and safety, social organization, legislation, commercial organization, transportation and documentation.

A visit to the International Exposition of Pure and Applied Chemistry at Charleroi, Belgium, and several plant visitations and excursions will complete the program of the Congress.

Arrange Metals Casting Conference

Two A.F.S. CHAPTERS are cooperating with Purdue University in holding a Metals Casting Conference in Lafayette, Indiana, November 4 and 5.

Sponsored by the Purdue department of general engineering, school of chemical and metallurgical engineering, technical extension division, with the cooperation of the Central Indiana Chapter and the Michiana Chapter, the conference will cover subjects of interest to top management, supervisory personnel, and technical and operating foundrymen.

The program committee met May 19 at A.F.S. Headquarters, Chicago, after a series of preliminary meetings, to start finalizing the conference program with the assistance of Technical Director S. C. Massari and Convention Manager A. A. Hilbron. Heading the committee is C. T. Marek, assistant professor in charge of casting processes. Other members of the committee are: P. H. Harlan, vice-president, Electric Steel Casting Co. Indianapolis, Ind.; Michiana Chapter Director F. T. McGuire, metallurgist, Sibley Machine & Foundry Corp., South Bend, Ind.; R. W. Lindley, professor and chairman of engineering shops; H. A. Bolz, professor and head of the general enginering department; and G. M. Enos, professor of metallurgical engineering, Purdue University.

Southern California Chapter Backs Los Angeles Smog Control Campaign

THE SOUTHERN CALIFORNIA CHAPTER, working in cooperation with the Los Angeles Air Pollution Control Board, has been instrumental in enforcing California's Smog Control Act and in the establishment of standards whereby emissions may be classified.

Three committees, covering gray iron, steel and non-ferrous foundries, have been set up by the Chapter in compliance with a request of the Los Angeles Chamber of Commerce, to study the smoke problem in Southern California foundries.

The California Smog Control Act provides that industries contributing to pollution of air be required to reduce the emission to a non-objectionable level. Failure to conform with this provision can lead to loss of the offender's business permit. Since this law affects almost all foundries in the area, the Chapter is extending every effort to help foundries overcome individual smoke control problems.

Future Meetings and Exhibits

SOCIETY OF AUTOMOTIVE ENGINEERS, West Coast Meeting, St. Francis Hotel, San Francisco—August 18-20.

AMERICAN CHEMICAL SOCIETY, 114th National Meeting, Eastern Session, Washington, D. C.—August 30-September 3.

AMERICAN CHEMICAL SOCIETY, 114th National Meeting, Midwest Session, St. Louis—September 6-10.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, Fall Meeting, Reed College, Portland Ore.—September 7-9.

INSTRUMENT SOCIETY OF AMERICA, National Instrument Conference and Exhibit, Convention Hall, Philadelphia—September 13-17.

AMERICAN CHEMICAL SOCIETY, 114th National Meeting, Western Session, Portland, Ore.—September 13-17.

INTERNATIONAL FOUNDRY CONGRESS AND EXHIBITION, Prague, Czechoslovakia—September 15-19.

NATIONAL ASSOCIATION OF FOREMEN, 25th Annual Convention, Convention Hall, Philadelphia—September 23-25.

ASSOCIATION OF IRON & STEEL ENGINEERS, Annual Convention, Public Auditorium, Cleveland—September 28-October 1.

ALL-CANADIAN FOUNDRY CONFERENCE, Montreal, Quebec, Canada—September 30-October 1.

NEW ENGLAND MATERIALS HANDLING EXPOSITION, Mechanics Hall, Boston—October 5-7.

ASSOCIATION TECHNIQUE DE FONDERIE, 22nd Annual Congress, Paris, France—October 8-9.

AMERICAN SOCIETY OF TOOL ENGINEERS, Semi-annual Convention, Pittsburgh—October 10-12.

AMERICAN CHEMICAL SOCIETY, National Exposition, Coliseum, Chicago—October 12-16.

MAGNESIUM ASSOCIATION, Midyear Meeting, Skytop Club, Skytop, Pa.—October 13-14.

GRAY IRON FOUNDERS SOCIETY, Annual Meeting, Atlantic City, N. J.—October 14-15.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION, Annual Meeting, White Sulphur Springs, W. Va.—Oct. 14-16.

NON-FERROUS FOUNDERS' SOCIETY, Annual Meeting, Philadelphia—October 22.

American Foundrymen's Society, 53rd Annual Foundry Congress, St. Louis—May 2-5, 1949.

WHO'S WHO

E. S. Schwartz

Earl S. Schwartz, author of *"Utilizing Non-Ferrous Scrap Conserves Metal Resources"*, Page 38, has attended four colleges, holds a law degree from John Marshall College, and has studied metallurgy and industrial management . . . Born in Chicago, he attended Central YMCA College there in 1929 and the same year joined H. Kramer & Co., Chicago . . . Resigned to open a law practice until 1933, when he rejoined H. Kramer & Co. . . . Appointed assistant works manager in 1940 and works manager in 1947, the position he holds today . . . Mr. Schwartz is a member of the A.F.S., the ASM, the ASTM, and the Alpha Sigma Iota legal fraternity.

H. A. Fabert, Jr.

Herman A. Fabert, Jr., co-author of *"Effects of Boron Additions On Malleabilization of White Cast Iron,"* pages 30-37, submitted the article in collaboration with Joseph E. Miksch as a senior thesis at Case Institute of Technology this year . . . Served as laboratory technician, Park Drop Forge Co., Cleveland, 1939-42 . . . Entered U. S. Army Corps of Engineers as 1st Lieutenant, serving in the Pacific . . . First presented paper before A.F.S. Ohio Regional Conference, Cleveland, this year . . . Is now metallurgical engineer, American Manganese Steel Co.

J. E. Miksch

Joseph E. Miksch, co-author of *"Effects of Boron Additions on Malleabilization of White Cast Iron,"* collaborated on the paper with H. A. Fabert, Jr., as a senior thesis at Case Institute of Technology this year . . . Born Nov. 25, 1920, in Cleveland, he attended grade and high schools there . . . Entered the U. S. Army Air Forces in 1942 . . . Served as Captain and was awarded the Bronze Star Medal . . . Received his B. S. in metallurgical engineering this June and is now assistant to the research director at Lake City Malleable Co., Cleveland.

R. G. McElwee

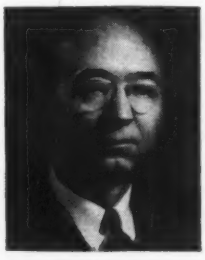
R. G. McElwee, author of *"Gray Cast Iron — Relationship of Composition and Properties,"* Page 46, is chairman of the A.F.S. Gray Iron Division and the A.F.S. Cupola Research Committee . . . A native of Williamsburg, Pa., Mr. McElwee began his career with the Muncie, Ind., Foundry & Machine Co. 31 years ago as chief inspector . . . He has been associated with General Motors Truck Co., American Car & Foundry Co., Whitehead & Kales Co., and Ecorse (Mich.) Foundry Co. . . . Today, Mr. McElwee is manager of the Iron Foundry Division of the Vanadium Corp. of America, Detroit . . . For his outstanding services to the A.F.S. he was this year awarded the Penton Gold Medal at the 52nd Annual Foundry Congress . . . Mr. McElwee is widely known for the many technical papers he has presented before various metals societies.

G. M. Cover

Gerald M. Cover, co-author with H. A. Fabert, Jr., and J. E. Miksch of *"Effects of Boron Additions On Malleabilization of White Cast Iron"*, is associate professor of Metallurgical Engineering at Case Institute of Technology . . . Holder of an M. S. in metallurgical engineering from Case, Dr. Cover received his Ph. D. from Ohio State University in 1935 . . . Began as a chemical analyst with Youngstown Sheet & Tube Co. in 1917 and was metallurgist with Weirton Steel Co., Weirton, W. Va., for six years . . . Became instructor in metallurgy at Case 1930 . . . Served as metallurgist for Battelle Memorial Institute 1934-35 . . . Rejoined Weirton Steel as Asst. to V. P. 1935-38, then returned to Case in his present position . . . Served as investigator with the War Production Board during World War II . . . Author of many technical papers published and presented before meetings of technical societies, Dr. Cover is a member of the board of directors of the A.F.S. Northeastern Ohio Chapter; secretary-treasurer of the Cleveland section, AIME; past chairman of the Cleveland Chapter ASM and a member of several of that society's national committees.

H. J. Jacobson

H. J. Jacobson, owner of Industrial Pattern Works, Chicago, specializes in high production metal pattern equipment. He called on his experience in this field in writing *"Designing and Rigging for Core Blowing,"* pages 41-45. Born in Cincinnati 45 years ago, he went to Chicago at the age of 12 . . . Mr. Jacobson is a journeyman patternmaker having served his apprenticeship in Chicago jobbing shops. For four of the 13 years he was with the Pyle-National Co., Chicago, he was in charge of the wood and metal pattern shop . . . He formed his own organization in 1935 and has developed it into one of the best equipped shops in the area, employing 45 men . . . Long interested in apprentice training, Mr. Jacobson worked on the original apprentice training standards for the Chicago area in cooperation with the US Apprentice Training Service. He has lectured before the Chicago Chapter of A.F.S. and before pattern apprentice groups at the Apprentice Club.



W. A. Spindler

W. A. Spindler, *"Centrifugal Casting — Calculations and Feeding Pressures,"* page 57, is assistant professor, College of Engineering, University of Michigan . . . Born in Fort Wayne, Ind., he received his M.S. from Michigan . . . Began his foundry career with the Detroit Gray Iron Foundry as a clerk in 1925 . . . Appointed metallurgist, Detroit Alloy Steel Co. . . . Later affiliated with the University of Michigan as an instructor from 1930 to 1933 . . . Became assistant professor in 1933 . . . Authored *"Immersion Thermocouple, Simplified Protection Tube"* in the April, 1947, AMERICAN FOUNDRYMAN.

BOOK REVIEWS

Copper In Ferrous Alloys

Copper as an Alloying Element in Steel and Cast Iron, by C. H. Lorig and R. R. Adams. xii, 213 pp. $3.00. McGraw-Hill Book Co., Inc., 330 West 42nd St., New York, 18 (1948).

Possibilities and limitations of copper as an alloying element in iron and steel are discussed, as are the commercially useful properties of copper-bearing ferrous alloys.

Chapters of particular interest to foundrymen are: "Cast Copper Steels"; "Corrosion Resistance of Copper Steels"; "Constitution and Structure of Copper Cast Iron and Malleable Iron"; Copper Cast Iron; and "Copper Malleable Iron."

In "Cast Copper Steels," the production, mechanical properties, fatigue properties and some applications are described. These include: crankshafts, pistons, brake drums, valve inserts, axle housings, gears, lift rods and ram arms, clutch pedals, sand-pump parts, steel rolls, and miscellaneous applications which also include ordnance castings. For each of these uses the composition and the mechanical properties are given.

The chapter on copper cast iron shows the increased applications of iron resulting from the increased range of specifications developed by the addition of varying amounts of copper. Some of these applications are: mine hoist drums, cylinder blocks, heads, sleeves and liners, push rods, camshafts, flywheels, gears, brake drums, clutch shells, glass molds, pumps and compressors, and cast-iron pipe.

The addition of copper to malleable iron increases the mechanical properties, decreases the time for graphitization, and increases the resistance to some forms of corrosion. These are valuable assets in the applications discussed in the chapter "Copper Malleable Iron." Some of these uses are bearing retainers, hand tools, heavy castings especially when resistance to atmospheric corrosion is necessary), and pipe fittings. The corrosion resistance is particularly valuable in the latter application too.

The authors consider their book a resumé to bring the work of J. L. Gregory and B. N. Daniloff, *Alloys of Iron and Copper,* up to date.

The bibliography of 102 references provides material for extensive further study of the subject.

Ferro-Alloys

Pig Iron and Blast Furnace Ferroalloys, Section I of the *Steel Products Manual* ii, 22 pp. $0.25. American Iron and Steel Institute, 350 Fifth Ave., New York 1. (Revised May 1948).

The General Technical Committee of the American Iron and Steel Institute found that pig iron producers were manufacturing hundreds of different combinations of chemical elements when many specifications with like requirements could be combined. These combinations of proven merit and extensive use for a variety of purposes were designated "Standard Grades of Pig Iron."

The "Standard Grades" are listed in tabular form and are codified to indicate phosphorus silicon and manganese content.

The table of expected differences among analysts working on a properly divided set of drillings from the same sample of pig iron should be very helpful in settling disputes and checking work of analysts.

Ferroalloys are defined in the last part of the booklet and descriptions, uses, and typical analyses of specific ferroalloys are given.

Aluminum Alloy Analysis

Analytical Methods for Aluminum Alloys. 103 pp. *Aluminum Research Institute,* 111 West Washington Blvd., Chicago 2. (1948).

Aluminum uses have increased so rapidly requiring higher degrees of accuracy and speed in analysis that new analytical tools had to be developed. These methods are given in this new edition of *Analytical Methods for Aluminum Alloys.*

The chemical, photometric, and spectrographic methods for quantitative determination of all elements commonly found in aluminum alloys are presented.

Part I discusses the sampling of aluminum casting alloys. Recommendations and precautions are given for the sampling methods.

In Part II the chemical methods for determining chromium, copper, lead, magnesium, manganese, nickel, silicon, tin, and zinc are covered. In each case the particular method for that determination, its principle, range, reagents required, and procedure are given. Detailed notes follow and in some cases there are bibliographical references.

Discussion of instrumental methods of analysis is in Part III. Section A contains information on photometric methods for precise quantitative analysis. The elements considered are bismuth, chromium, iron, magnesium, manganese, nickel, silicon, and titanium. Section B describes spectrographic methods of analysis and the equipment needed. Detailed information for three instruments is given, including wave length tables with the range of concentration covered.

Vanadium Steels

Vanadium Steels for Locomotive and Car Construction. iv, 88 pp. Gratis. The Vanadium Corporation of America, 420 Lexington Ave., New York 17. (1948).

Concise information concerning vanadium alloy steels and irons is given so that designers and builders of railway equipment may select the best for the specific application.

The Technical Section includes vanadium cast irons for valve liners, bushings, guides, piston rings, cylinder heads, etc. for steam locomotives; heads, blocks, liners, pistons, etc. for Diesel locomotives. There are four recommended specifications for locomotive castings, both steam and Diesel, with specific reference to the type of application for which each is best suited.

The three types of vanadium cast steels used most extensively for locomotive and car construction are carbon-vanadium, manganese-vanadium, and nickel-vanadium steel. These are listed with chemical composition, mechanical properties, and particular application for each type.

The use of vanadium steel for both elliptic and helical springs is described with particular reference to composition and mechanical properties. Manganese-vanadium steels for locomotive boiler plates

and for plates and shapes are discussed and recommended because of their high strength at elevated temperatures. The vanadium steels and irons for Diesel construction, with recommended compositions for various parts, are presented.

Specifications for the various vanadium steels—i.e., carbon-vanadium, chromium-vanadium, chromium-molybdenum-vanadium, manganese-vanadium, nickel-vanadium, and silicon-vanadium—are given in the second part of the book. These specifications include the manufacture, chemical properties and tests, heat treatment, finishes, marking, inspection, and rejection. In some cases the permissible variations from specification are given in the volume.

Steel Castings

Steel Castings, by Eric N. Simons. viii, 208 pp. Price $5.00. Published by the Chemical Publishing Co., Inc., Brooklyn, N.Y., (1947).

Steel Castings is the first American edition of the author's book based on British practice.

It is a compendium of steel practice gathered from books on pattern making, metallurgy, foundry work, etc., as well as the author's own information. The chapters discuss the subject from the raw materials, through the various processes, and the finished products.

There are many illustrations showing typical castings made to show applications of foundry technology. One chapter gives practical advice on purchasing steel castings, and in particular their packing specifications.

Steel Castings is an excellent book for non-professional persons who want an elementary knowledge of the steel casting business. It is written in language that the average laymen can understand.

Corrosion Handbook

Corrosion Handbook, edited by Herbert H. Uhlig. xxxiii, 1188 pp. Price $12.00. Published by John Wiley & Sons, Inc., N.Y.; Chapman & Hall, Ltd., London, (1948).

Mr. Uhlig, assisted by a nine-man advisory board, selected 103 authorities in their particular fields to write on those topics. These writings have been correlated to produce the *Corrosion handbook* which is sponsored by the Electrochemical Society, N.Y.

A lengthy glossary of terms and a list of abbreviations precedes the text proper. Section I contains discussions on the corrosion theory, and in particular the electrochemical theory; Section II, corrosion in liquid media, the atmosphere, and gases; Section III, special topics in corrosion; Section IV, high-temperature corrosion; Section V, high-temperature resistant materials; Section VI, chemical resistant materials; Section VII, corrosion protection; Section VIII, corrosion testing; Section IX, miscellaneous information.

Some chapters have references at the end, and there are bibliographical footnotes throughout the book.

The book is well indexed and "T," "F" and "FN" after a page number indicate "Table," "Figure," and "Footnote" which aids in finding the reference quickly.

Maintenance or replacement costs have taken a considerable amount of our national income. The constant replacement of corroded parts accounts for the greatest amount of this item. Scientists and technologists have applied their efforts to cut down the toll in their work to protect metal from corrosion. The collected material in this book makes a stupendous contribution. It is really a text or manual rather than a handbook and the number of experts who have written for it have made it valuable for any one working with metals.

Apprentice Training

Industrial Apprenticeship, by Paul Bergevin. xv,280pp. Price $2.75. McGraw-Hill Book Co., Inc., N.Y. (1947).

Planned apprenticeship training is needed to provide a continuous supply of well-trained skilled labor. This book aims to present principles for apprentice education so that the training program can be established on a sound foundation. Supervisors of educational programs can evaluate their programs in terms of these principles.

Management, vocational educators, apprentice-training supervisors, individuals and companies interested in establishing apprentice-training will find this book a useful guide. The extensive bibliography includes from 1901-1947 but most of them are in the 1940's so that it is a valuable aid for further study of the subject.

Mr. Bergevin is well qualified to write on apprentice training. He began his apprenticeship in 1924, became a journeyman and engineer. His interest in apprentice education resulted in his establishing an apprentice school ten years ago. This serves fifteen large and small industries in a community. During the past five years he made investigations in thirty plants and unions regarding good apprenticeship standards. This book is a practical result of those efforts.

British Founding

The Foundryman's Compendium, by Foundry Services Ltd. 2nd ed., 111 pp. Price leather 7/6, paper binding 5/-. Published by Foundry Services, Ltd., Birmingham, England, (1947).

A compilation chiefly of tables referring to British standards, and the products and services of the Foundry Services, Ltd.

Industrial Weighing

Industrial Weighing, by Douglas M. Considine. ix, 553 pp. Price $10.00. Published by Reinhold Publishing Corp., 330 West 42nd St., N.Y. (1948).

Weighing is one of the earliest industrial operations, yet there has been very little literature on the subject. Scientific progress in a competitive world has made it necessary to become more exact for quality control and production economy. The new equipment designs for the various applications have made a complete and modern book necessary for people interested and using scales, and Mr. Considine has made a valuable contribution.

Industrial Weighing is in two parts. Part I deals with scale design, construction and operation. This includes chapters on the fundamentals of scale mechanics; theory of scale operation; scales for basic weighing; printing and counting scales; automatic weighers, design considerations; selection, installation and maintenance. Part II, scales in the industries, contains chapters on: mining, machinery and metals products; chemical industries; public works, service, and transportation industries; food industries; textile and paper industries; rubber and plastics industries; and a glossary of scale terms.

Of particular interest to foundrymen is the chapter on mining, machinery, and metal products. This

(*Continued on Page 97*)

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Treasurer—George E. Tisdale, Secy-Treas., Zenith Foundry Co., West Allis.
Directors—Terms expire 1949
C. M. Lewis, Sec'y.-Treas., Badger Malleable & Mfg. Co., South Milwaukee.
Arthur K. Higgins, Met., Allis-Chalmers Mfg. Co., Milwaukee.
Directors—Terms expire 1950
Walter W. Edens, Tech. Dir., Badger Brass & Aluminum Foundry Co., Milwaukee.
A. F. Pfeiffer, Pattern & Foundry Div., Allis-Chalmers Mfg. Co., Milwaukee.
J. G. Risney, Owner, Risney Foundry Equipment Co., Milwaukee.
Directors—Terms expire 1951
R. J. Anderson, Wks. Mgr., Belle City Malleable Iron Co., Racine.
S. E. Mueller, Fdry. Res. Engr., Falk Corp., Milwaukee.
J. V. Olle, Met., Motor Castings Co., West Allis.

Plan Industrial Training Conference

A TWO-DAY CONFERENCE on Industrial and Business Training, sponsored by Purdue University's Technical Extension and Division of Education and Applied Psychology, will be held at the Purdue Memorial Union, Lafayette, Ind., September 29 and 30.

The conference, to be held in cooperation with the American Society of Training Directors and state training associations of Illinois, Indiana, Michigan, Ohio, Missouri and Wisconsin, will consist of workshop sessions with panels of experts serving as discussion guides. The Conference is designed for the guidance of full-time industrial training directors, those having part-time responsibility in training, and anyone else interested in industrial training.

Primary objectives of the Conference are the analysis and determination of training needs, and the development of training programs as an outgrowth of these needs. Panel discussions will cover sales, management and general employee training.

New AFS MEMBERS

Period June 15 — July 15: Four conversions—three to sustaining membership—and three new company memberships along with 123 new personal members mark this period. Leading chapters of 26 showing increases were Birmingham with 33 and Tennessee with 13 new members.

CONVERSIONS

Company to Sustaining

Buckeye Foundry Co., Cincinnati—Wm. Gilbert, Jr. (Cincinnati Chapter).
Glamorgan Pipe & Foundry Co., Lynchburg, Va.—J. C. Dabney, Jr., V.P. (Chesapeake Chapter).
Roberts Brass Mfg. Co., Detroit—L. C. Smith, Jr., Factory Mgr. (Detroit Chapter).

Personal to Company

Rich Mfg. Co., Portland, Ore.—E. J. Hyche, V.P. (Oregon Chapter).

NEW COMPANY MEMBERS

Allis-Chalmers Mfg. Co., LaCrosse, Wis.—Robert Hirshheimer, Supt. Wisconsin Chapter).
Great Lakes Mfg. & Foundry Co., Wyandotte, Mich.—Thos. H. Conway, Jr., Pres. (Detroit Chapter).
National Lead Co., Magnus Metal Div., Albany, N.Y.—R. H. Croft, Fdry. Mgr. (Eastern New York Chapter).

BIRMINGHAM DISTRICT CHAPTER

Robert Barksdale, Frm., Central Foundry Co., Holt, Ala.
Eugene Bates, Frm., Central Foundry Co., Holt, Ala.
T. L. Burgess, Frm., Central Foundry Co., Holt, Ala.
L. B. Burnett, Frm., Central Foundry Co., Holt, Ala.
Harry Craig, Frm., Central Foundry Co., Holt, Ala.
Henry Dutton, Frm., Central Foundry Co., Holt, Ala.
G. S. Elkins,, Frm., Central Foundry Co., Holt, Ala.
W. H. Gates, Frm., Central Foundry Co., Holt, Ala.
H. C. Goodwin, Frm., Central Foundry Co., Holt, Ala.
L. P. Hardin, Frm., Central Foundry Co., Holt, Ala.
Joe Harmon, Frm., Central Foundry Co., Holt, Ala.
W. L. Hester, Frm., Central Foundry Co., Holt, Ala.
J. P. Hitt, Frm., Central Foundry Co., Holt, Ala.
Burt Hobbs, Frm., Central Foundry Co., Holt, Ala.
Fred Innes, Frm., Central Foundry Co., Holt, Ala.
Floyd Jennings, Frm., Central Foundry Co., Holt, Ala.
Webster Jennings, Frm., Central Foundry Co., Holt, Ala.
O. L. Jones, Frm., Central Foundry Co., Holt, Ala.
R. E. Jones, Frm., Central Foundry Co., Holt, Ala.
Webster Jones, Frm., Central Foundry Co., Holt, Ala.
J. B. Kirby, Frm., Central Foundry Co., Holt, Ala.
Archie Marlow, Frm., Central Foundry Co., Holt, Ala.
H. J. Moore, Frm., Central Foundry Co., Holt, Ala.
Boyd B. Nall, Frm., Central Foundry Co., Holt, Ala.
J. W. Owen, Frm., Central Foundry Co., Holt, Ala.
H. Clark Pope, Sec'y. & Treas., Southeastern Castings Co., Anniston, Ala.
Lucien H. Rast, Frm., Central Foundry Co., Holt, Ala.
G. W. Robertson, Frm., Central Foundry Co., Holt, Ala.
R. E. Sellers, Frm., Central Foundry Co., Holt, Ala.
Ross Smith, Frm., Central Foundry Co., Holt, Ala.
H. T. Summerhill, Frm., Central Foundry Co., Holt, Ala.
M. D. Tucker, Frm., Central Foundry Co., Holt, Ala.
G. P. West, Frm., Central Foundry Co., Holt, Ala.

CENTRAL INDIANA CHAPTER

Robert E. Coady, Plant Mgr., Hoosier Iron Works, Kokomo, Ind.
Emmett B. Haas, Supv., Swayne, Robinson & Co., Richmond, Ind.
Gail P. McCleary, Student, International Harvester Co., Richmond, Ind.
Ralph W. Tresser, Jr., Pattern Layout Man, National Malleable & Steel Castings Co., Indianapolis, Ind.
Harry R. Walterman, Frm., Swayne, Robinson & Co., Richmond, Ind.

CENTRAL NEW YORK CHAPTER

Grant N. Pealer, Prop., Elmira Pattern Works, Elmira, N.Y.

CENTRAL OHIO CHAPTER

Wm. Robert Simendinger, Western Foundry & Mfg. Co., Springfield, Ohio.

CHESAPEAKE CHAPTER

William H. Johnson, Met., Naval Research Laboratory, Washington, D.C.

CHICAGO CHAPTER

Ernest Baenninger, Grad. Stud., Walworth Co., Inc., Kewanee, Ill.
George W. Higgins, Met., Kensington Steel Co., Chicago.
James H. Nichols, Chief Insp., Western Foundry Co., Chicago.
Fred W. Scheck, Engr., Whiting Corp., Harvey, Ill.
Richard Schuettpelz, Owner, National Pattern Supply Co., Chicago.
Melvin Seligman, Met. & Partner, M. Seligman Co., Chicago.
Willard P. Tissing, Asst. Met., Western Foundry Co., Chicago.

CINCINNATI DISTRICT CHAPTER

Carl W. Friedrich, Appr., Cincinnati Milling Machine Co., Cincinnati.
G. F. Vogt, Sec'y., The Star Foundry Co., Covington, Ky.

DETROIT CHAPTER

***Great Lakes Mfg. & Foundry Co., Wyandotte, Mich. (Thos. H. Conway, Jr., Pres.).**
Arthur R. Crawford, Vice-Pres., Atlas Foundry Co., Detroit 17.
Joseph G. Fabiano, Appr., Cadillac Motor Car Co., Detroit.
Dushane Kosanovich, Fdry. Lab., Cadillac Motor Car Div., GMC., Detroit.
Elma G. Liddle, Exec. Sec.-Treas., Plumbing & Drainage Mfgrs. Assn., Detroit.
Ralph L. Price, Mich. Dist. Sls. Mgr., Peninsular Grinding Wheel Co., Detroit.
Leonard J. Williams, Frm., Steel Jobbing Molding, Ford Motor Co., Dearborn, Mich.

E. CANADA & NEWFOUNDLAND CHAPTER

Phokion Stamatopoulos, Stud. Met., McGill University, Montreal, Que.

EASTERN NEW YORK CHAPTER

***National Lead Co., Magnus Metal Div., Albany, N.Y. (R. H. Croft, Fdry. Mgr.).**
William H. Croft, III, Asst. Fdry. Mgr., National Lead Co., Magnus Metal Div., Albany, N.Y.
George Donley, Asst. Supt. of Fdry. National Lead Co., Magnus Metal Div., Albany, N.Y.
Harry Flasser, Frm., National Lead Co., Magnus Metal Div., Albany, N.Y.
A. MacMartin, Frm., National Lead Co., Magnus Metal Div., Albany, N.Y.
W. T. Miller, Frm., National Lead Co., Magnus Metal Div., Albany, N.Y.
N. R. Van Ullen, Fdry. Supt., National Lead Co., Magnus Metal Div., Albany.

METROPOLITAN CHAPTER

S. B. Ashkinazy, Mat'l. & Process Supt., Sperry Gyroscope Co., Great Neck, L.I., N.Y.
Robert A. Colton, Res. Met., American Smelting & Refining Co., Perth Amboy, N.J.
Joseph H. Mulherin, Asst. Met., American Brake Shoe Co., Mahwah, N.J.
Rene K. Price, Export Sales Mgr., Milwaukee Fdry. Equipment Co., New York.
John J. Rohm, Gen. Mgr., J. Rohm & Sons Foundry Co., Kenilworth, N.J.
Stephen Wysocki, Res. Met. Engr., Manning, Maxwell & Moore Inc., New Haven, Conn.

MEXICO CITY CHAPTER

Ricardo Menendez, Credito Minero y Mercantil, S.A., Mexico, D.F.

MICHIANA CHAPTER

William Wishart, Fdry. Chemist, Dodge Mfg. Corp., Mishawaka, Ind.

NORTHWESTERN PENNSYLVANIA CHAPTER

Duane P. Davis, Urick Foundry Co., Erie, Pa.

ONTARIO CHAPTER

Don Barnes, Jr., Student, Don Barnes Foundry Supplies & Equipment Co., Hamilton, Ont.
Charles Reuben Casson, Molder, Canadian Scale Co., Toronto, Ont.
Clarence O. Gerbrandt, Cereal Chemist, J. R. Short Canadian Mills Ltd., Toronto.

PHILADELPHIA CHAPTER

Victor W. Anckaitis, Mgr., Lehigh Foundry, Inc., Easton, Pa.
W. Warren Cady, Tech. Repr., Frank Bancroft Co., Philadelphia.
Robert J. Urban, Patt. Shop Frm., Lebanon Steel Foundry, Lebanon, Pa.

QUAD CITY CHAPTER

Camile DeWilde, Asst. Frm., International Harvester Co., Farmall Works, Rock Island, Ill.

* Company Members

Melvin C. Ford, Asst. Frm., International Harvester Co., Farmall Works, Rock Island, Ill.
Maurice J. Gohmann, Stud., International Harvester Co., Farmall Works, Rock Island, Ill.
Robert Hendry, Patt. Supt., J. I. Case Co., Bettendorf, Iowa.
Arthur Lamp., Frm., Kelsey Hayes Wheel Co., French & Hecht Div., Davenport, Iowa.

SAGINAW VALLEY CHAPTER

Sigmond H. Howard, Sls. Branch Mgr., American Red Star Co., Saginaw, Mich.
William J. Howell, Asst. Pur. Agent, Chevrolet Gray Iron Foundry, GMC, Saginaw, Mich.
Lawrence C. Johnson, Purch. Agent, Eaton Mfg. Co., Vassar, Mich.
Michael J. O'Connor, Gen. Frm., Central Foundry Div., GMC, Saginaw, Mich.
L. F. Stephenson, Supv., Core Room, Buick Motor Div., GMC, Flint, Mich.

ST. LOUIS DISTRICT CHAPTER

Fred J. Passino, Sales Engr., Cleco Div., Reed Roller Bit Co., St. Louis.
George A. Wilkin, Pickands Mather & Co., St. Louis.

SOUTHERN CALIFORNIA CHAPTER

Marley J. Oberlies, Chief Insp., Hanford Foundry Co., Bell, Calif.
Leo N. Wood, Triplett & Barton, Inc., Canoga Park, Calif.

TENNESSEE CHAPTER

George S. Acton, Frm., Combustion Engineering Co., Inc., Chattanooga.
James A. Blake, Frm., Combustion Engineering Co., Inc., Chattanooga.
Joseph E. Connors, Time Study Engr., U. S. Pipe & Foundry Co., Chattanooga.
T. A. Deakins, Engr., Combustion Engineering Co., Inc., Chattanooga.
M. H. Gunther, Supt., Strickland Pattern Works, Chattanooga.
John A. Lasater, Engr., Combustion Engineering Co. Inc., Chattanooga.
William K. Levi, Frm., Core Room, U. S. Pipe & Foundry Co., Chattanooga.
Carl McFarlin, Pres., Tennessee Product & Chemical Corp., Nashville.
James Minter, Dist. Sls. Mgr., A. P. Green Fire Brick Co., Chattanooga.
Barney Strickland, Pres., Strickland Pattern Works, Chattanooga.
C. S. Turner, Frm., Combustion Engineering Co., Inc., Chattanooga.
Robert C. White, Dist. Repr., Syntron Co., Nashville.
Earl E. Wright, Owner, Dixie Industrial Service, Chattanooga.

TOLEDO CHAPTER

Thomas H. O'Neil, Vice-Pres., Multi-Cast Corp., Wauseon, Ohio.

WESTERN MICHIGAN CHAPTER

E. L. Downs, Field Repr., Lakey Foundry & Machine Co., Muskegon Hts., Mich.
Glen Lownds, Chief Insp., Lakey Foundry & Machine Co., Muskegon Hts., Mich.

WESTERN NEW YORK CHAPTER

Kenneth L. O'Brien, Chief Chemist, Symington-Gould Corp., Depew, N.Y.

WISCONSIN CHAPTER

*Allis-Chalmers Mfg. Co., LaCrosse, Wis. (Robert Hirshheimer, Supt.).
Elroy G. Eberhardt, Time Study, Pelton Steel Castings Co., Milwaukee.
Harold D. Halstrom, Pttnmkr., Brillion Iron Works, Inc., Brillion, Wis.
Robert M. Ramage, Austin Gray Iron Foundry Corp., Sheboygan, Wis.

STUDENT CHAPTERS

MISSOURI SCHOOL OF MINES

Robert Joseph Morris William S. Pippert Joseph Soja

OUTSIDE OF CHAPTER

George Liff, Vice-Pres., Klein-Farris Co., Inc., Boston, Mass.
Joseph J. Zisk, Frm., North & Judd Mfg. Co., New Britain, Conn.

China
C. F. Cheng, Imperial Chemical Industries Ltd., Shanghai.

Finland
Gardar Alcenius, Prod. Mgr., W. Rosenlew & Co., Pori.

India
R. N. Prasad Singh, Sadarbazar, E. I. Rly Jamalpur, Dist. Monghyr.
G. Ramakrishnan, 5/8 Imperial Bank Road, Coimbatore.

Italy
Dott. Ing. Vincenzo Ventafridda, Dir., Acciaierie di Bolzano, Bolzano.

Sweden
Carl-Gustaf Soderlund, Fdry. Mgr. & Chief Engr., Husqvarna Vapenfabriks Aktiebolag, Huskvarna.

OLD TIMERS ATTEND 52nd FOUNDRY CONGRESS

INCLUDED IN THE RANKS of the more than 300 "old timers" attending the 52nd Annual Foundry Congress in Philadelphia, May 3-7, were 48 veterans with over 50 years' service to the foundry industry. Foundrymen with more than three-score years' service records were B. D. Fuller, 84, retired, Lakewood, Ohio, 67 years; M .E. Dolan, retired, Louisville, Ky., 65 years; W. A. Hoffman, Burnham Corp., Elizabeth, N.J., 65 years; Barnet Bernbaum, retired, East Cleveland, Ohio, 64 years; and A. H. Quitman, Yale & Towne Mfg. Co., Stamford, Conn., 61 years. Those with more than 50 years in the foundry industry were:

W. E. Rayel, Werner G. Smith Co., Cleveland, 54 years; A. H. Lindsay, Jr., Hunt-Spiller Mfg. Corp., Boston, 50 years; H. P. Mackinnon, Great Lakes Foundry Sand Co., Newton, Mass., 50 years; Archie Stewart, Manitoba Steel Foundry, Manitoba, Can., 51 years; Joseph B. Medley, Tallman Bronze Co., 50 years; James S. Keeley, Northern Bronze Corp., North Hills, Pa., 53 years; William Albohn, Western Industrial Supply Co., 56 years.

James Thomas, Shenango Penn Mold Co., Sharon, Pa., 52 years; G. P. Delaney, Naval Foundry, Washington, D.C., 52 years; John Z. Harner, Union Mfg. Co., Inc., Boyertown, Pa., 52 years; William J. Jordan, Oliver Corp., Springfield, Ohio, 50 years; Charles Wegelin, Birmingham, Ala., 50 years; David MacIntosh, Maplewood, N.J., 59 years; Irwin Leiss, Leiss Metal Products, Inc., Allentown, Pa., 54 years; Guy E. Lund, Chicago, 55 years.

John B. Vernon, Philadelphia, 50 years; Charles Schneider, Brisk Foundry & Machine Co., Imlay City, Mich., 57 years; Oliver J. Charette, A. P. Smith Mfg. Co., South Orange, N.J., 52 years; H. J. Sprecken, International Harvester Co., Baldwin, Mich., 51 years; Thomas Dallas, Baldwin Locomotive Works, Philadelphia, 50 years.

H. Doran, Whiting Corp. (Canada) Ltd., Montreal, Que., Can., 52 years; Herbert A. Newberry, Newberry Mfg. Co., Talladega, Ala., 54 years; Egbert H. Ballard, Swampscott, Mass., 50 years; Norman S. Snow, Hogland & Hardy Sand Co., Evansville, Ind., 53 years; E. A. Johnson, Johnson Brass Foundry, Newton Center, Mass., 53 years; Jerry E. Burley, North Wales Foundry, North Wales, Pa., 52 years.

Louis F. Wind., U. S. Reduction Co., Cleveland, 50 years; G. M. Beard, Standard Stoker Co., Hanover, Pa., 51 years; Fred W. Smale, National Malleable & Steel Castings Co., Lakewood, Ohio, 51 years; H. V. Adams, Foundry Supplies Mfg. Co., Chicago, 55 years; Andrew L. King, Berlenbach Foundry, Bethlehem, Pa., 51 years; Charles F. LaDue, A. P. Smith Mfg. Co., East Orange, N.J., 50 years.

Frank Ogden, White Bros. Smelting Corp., Upper Darby, Pa., 54 years; David Muir, Frederick B. Stevens of Canada, Ltd., Hamilton, Ont., Can., 50 years; James W. Scott, Brown Boggs Co., Ltd., Hamilton, Ont., Can., 50 years; L. M. Bassini, Monroe Steel Castings Co., Monroe, Mich., 51 years; Pat Dwyer, Penton Publishing Co., Cleveland, 57 years.

John McDonald, Babcock, Wilcox, Goldie & McCulloch, Galt, Ont., Can., 50 years; David G. Anderson, National Foundry Association, Chicago, 50 years; Harry W. Impey, Tabor Mfg. Co., Philadelphia, 52 years; Roy Frazier, Love Bros., Inc., Aurora, Ill., 50 years; E. W. Beach, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., 52 years; Paul C. Vogel, Allis-Chalmers Mfg. Co., Milwaukee, Wis., 50 years; James F. Hines, Hines Flask Co., Lakewood, Ohio, 50 years; and P. J. Shire of the Tabor Mfg Co., Philadelphia, 51 years.

FOUNDRY *Personalities*

Professor Dana J. Demorest will resign as chairman of the department of metallurgy at Ohio State University on September 1 after 33 years on the staff. He will continue to teach four more years because "teaching is fun."

Professor Demorest joined the Ohio State staff in 1908 after graduating in 1907. He has been with the department of metallurgy, most of the time as chairman or acting chairman, except for a short period during the first world war when he served as a major in the Army.

Four June graduates, former members of the University of Minnesota Student Chapter, have started work in the foundry industry. They are: **Edward Oldfield,** mechanical engineer, who is working for the E. W. Bliss Co., Toledo, Ohio; **J. Donald Johnson,** aeronautical engineer, who will work for the Werner G. Smith Co., Minneapolis, this fall after spending the summer at American Hoist & Derrick Co., St. Paul; **Herman Rischall,** metallurgical engineer, who is working at American Hoist & Derrick Co.; and **Harvey S. Sauby,** mechanical engineer, who is working at Minneapolis-Moline Power Implement Co.

Lowell D. Ryan joined the Malleable Founders' Society, Cleveland, as managing director on June 7. He replaces **H. S. Colby,** MFS executive vice-president, who with **John J. Harant,** secretary-treasurer, retired May 31.

A native of Illinois, Mr. Ryan attended

L. D. Ryan

the University of Illinois and Lincoln College of Law. He practiced law in Springfield, Ill., and for a time worked for a daily newspaper there. In January, 1942, he entered the Federal Bureau of Investigation where he remained until October, 1944. Just before becoming managing director of the Malleable Founders' Society, Mr. Ryan was manager of the legislative department of the Illinois State Chamber of Commerce.

Herman A. Fabert, Jr. co-author, with **Joseph Micksch,** and **G. M. Cover,** of the paper on effects of boron on malleabilization of white iron in this issue of AMERICAN FOUNDRYMAN, is metallurgical engineer at American Manganese Steel Co., Chicago Heights plant of American Brake Shoe Co. Mr. Fabert graduated from Case Institute of Technology in June.

C. H. Moore of Chatham, N.J., has been appointed New Jersey and Pennsylvania representative for the Buckeye Products Co., Cincinnati. Mr. Moore, who studied engineering at the College of the City of New York, has been associated with the foundry industry in the area for more than 10 years.

William Valentine, for almost a quarter of a century patternmaker at the Engineered Castings department of American Brake Shoe Co., retired recently. During Mr. Valentine's entire career with the Company, he has had no lost time due to accidents.

William W. Criswell, Jr., has been appointed sales representative with offices in New York City for the American Wheelbrator & Equipment Corp., Mishawaka, Ind. A graduate in chemical engineering from the Massachusetts Institute of Technology, Mr. Criswell was formerly associated with the Rochester and Pittsburgh Coal Co. in a development and sales engineering capacity. Prior to that time he was employed by Combustion Engineering Corp.

Arthur J. Wieland, executive vice president of Willys-Overland Motors, has been elected chairman of the board of directors of the Wilson Foundry & Machine Co., Pontiac, Mich., succeeding the late Hiram J. Leonard. Mr. Wieland had previously been vice-chairman of the board at Wilson.

James M. Todd, New Orleans consulting engineer, was recently nominated president of the American Society of Mechanical Engineers during the Society's semi-annual meeting in Milwaukee. Regional vice presidents include: **Arthur Roberts, Jr.,** chief engineer, Lynchburg Foundry Co., Lynchburg, Va., Forrest Nagler, chief mechanical engineer, Allis-Chalmers Mfg. Co.; **C. J. Eckhardt,** professor of mechanical engineering at the University of Texas; and **Albert R. Mumford,** development engineer, Combustion Engineering Co. **Ralph A. Sherman** of the Battelle Memorial Institute was elected a director.

Several new executive appointments announced by the General Electric X-Ray Corp. include: **A. B. Muskett** to be vice president in charge of manufacturing; **R. R. Roberts,** to be administrative assistant to the executive vice president; and **E. Dale Trout,** to be tecnical assistant to the marketing manager.

F. C. Prescott and **C. N. Hathway** have been named assistant industrial relations manager and assistant labor relations manager, respectively, of the Caterpillar Tractor Co., Peoria, Ill. Mr. Prescott has been associated with Caterpillar since 1937, and Mr. Hathway since 1935.

Werner Finster, chief metallurgist, American Chain & Cable Co., Reading, Pa., has accepted the position of metal-

Werner Finster

lurgist with the Foundry Division of the Textile Machinery Works, Reading. Born and educated in Germany, Mr. Finster joined Carus Chemical Co., LaSalle, Ill., in 1927, and from 1928 to 1930 was with Deere & Co., Moline, Ill.

AFS member **Gopal Chandra Sen,** lecturer in mechanical engineering, Bengal college of engineering & technology, India, is rounding out a two year visit to the United States and will shortly return to Calcutta to assume his teaching duties. Sent by his college on a scholarship to study American manufacturing methods and to get an MS degree from the Univer-

sity of Michigan, he has spent considerable time in plant visitations getting first hand information on machine tools, machine design, and metal processing methods. Mr. Sen recently visited precision investment casting plants in Chicago.

Charles O. Burgess, for 25 years head of the Steel and Gray Iron Research Laboratories of Union Carbide & Carbon Co., Niagara Falls, N.Y., has been appointed technical director of the Gray Iron Founders' Society, Inc., Cleveland. Mr. Burgess will establish a technical department for the Society and initiate a long-range program of product improvement, technological development, handbook preparation, and technical research. Holder of 14 patents in the metallurgical field, Mr. Burgess was chairman of the A.F.S. Gray Iron Division in 1944-45 and served as chairman of CAST METALS HANDBOOK Committee at the time of the Handbook's last revision. He is the author of those sections of the CAST METALS HANDBOOK dealing with the corrosion and high temperature properties of cast iron.

C. O. Burgess

A February 1948 graduate of Massachusetts Institute of Technology, **James M. Barrabee** went to work immediately for the International Harvester Co., Richmond, Indiana. He is in training for work in foundry management and engineering.

Professor A. O. Rankine, O.B.E., D.Sc., F.R.S., who recently delivered the 37th May Lecture before the British Institute of Metals, London, on "The Search for Minerals by Physical Methods", is known throughout England for his scientific contributions to the development of submarine detection devices, photo-telephony and fog-dissipation during both World Wars. Holder of a D.Sc. from the University of London in 1910, Professor Rankine was for several years professor of Physics at the Imperial College of Science and Technology. In 1937, he resigned his post as professor emeritus of the College to become chief physicist to the Anglo-Iranian Oil Co. He recently resigned his full-time position with the company and is now retained in an advisory capacity. He has been president of the Physical Society and the British Association, and for five years served as secretary of the Institute of Physics. He has been manager of the Royal Institution of Childrens' Lectures and is presently secretary.

G. W. Merrefield, who recently resigned as senior engineer of Lester B. Knight & Associates, Chicago, has been appointed sales engineer for the Champion Foundry & Machine Co., Grand Haven, Mich. Mr. Merrefield, who has had more than 30 years' experience in foundry operations and sales, formerly managed the foundry operations for the Chicago Hardware Foundry, the Clark Equipment Co., Kay-Brunner, and U. S. Steel Corp.

W. W. Westler, assistant superintendent, has been appointed general superintendent of the meehanite foundry of Ross-Meehan Foundries. Mr. Westler entered the foundry industry in 1917 with the F. B. Zeig Mfg. Co., Frederickstown, Ohio; and was successively employed by the J. B. Foote Foundry Co., Cooper-Bessemer Co., and the Niagara Tool Works. He rejoined Cooper-Bessemer in 1937 as foundry cost engineer and assistant superintendent, prior to joining Ross-Meehan in 1943.

Ralph H. Maxson, president of the St. Paul Foundry & Mfg. Co., St. Paul, Minn., has been elected chairman of the board of directors of the W. L. Maxson Corp., New York Engineers and manufacturers. Mr. Maxson, whose home is in Canton, Ohio, has been a member of the board since the incorporation of the St. Paul Foundry & Mfg. Co. in 1935.

Walter Geist, president of Allis-Chalmers Mfg. Co., Milwaukee, was awarded an honorary doctor of engineering degree June 7 by the Michigan College of Mining and Technology, Houghton, Mich. Mr. Geist is a trustee of St. Olaf College, Northfield, Minn., a member of the board of governors of Marquette University, Milwaukee, and an associate of Northwestern University. He also holds an honorary doctor of laws degree from Lawrence College, Appleton, Wis. The award was made at the school's commencement ceremonies, which were addressed by **Leigh Willard,** president of the Interlake Iron Co. and the Interlake Chemical Co., and a director of Allis-Chalmers.

John A. Leisk, superintendent of foundries and pattern shops, Allis-Chalmers Mfg. Co., Milwaukee, with Mrs. Leisk celebrated his 50th wedding anniversary June 20. Mr. Leisk was recently honored at the Wisconsin Chapter's "Old Timers' Nite" for his 59 years of service with Allis-Chalmers Mfg. Co.

Gilfry Ward has been appointed vice-president of the Kellogg Division of the American Brake Shoe Co. Mr. Ward has been with Brake Shoe since graduating from college in 1928. In addition to his new duties, he will continue to serve as vice-president of the company's American Manganese Steel Division, a position which he has held since 1938. He will continue to be located in Oakland, Calif.

Adrian C. Den Breejen, Jr., has been appointed foundry superintendent of the Nichol-Straight Foundry Co., Chicago,,

A. C. Den Breejen, Jr.

where he completed his apprenticeship as a molder in 1934-35. Mr. Den Breejen was born in Amsterdam, Netherlands, in 1913, and attended the Armour Institute of Technology and the University of Minnesota, where he taught foundry practice from 1938 to 1940. He has served in various foundry supervisory capacities in Oklahoma, Minnesota, and Illinois, and in 1947-48 was foundry superintendent for the Pyott Foundry & Machine Co., Chicago. He has spoken at 20 or more A.F.S. chapters on sand problems.

J. Carl Bode, formerly operating manager, has been elected president of the National Carbide Corp., succeeding **A. L. Hull,** who becomes chairman of the board of directors. Mr. Bode has been with National Carbide since 1928 and Mr. Hull has been with National since 1917.

S. T. Jazwinski, chief metallurgist, Barium Steel Corp., and vice president of the corporation's subsidiary, Sheffield Iron & Steel Co., Sheffield, Ala., has been named vice-president of another of Barium Steel's subsidiaries, the Detroit Steel Castings Co. Polish born and educated, Dr. Jazwinski has served in executive metallurgical and foundry managerial capacities in Poland, England, and Brazil, prior to joining Barium Steel in 1946. He is the author of many books and papers on iron and steel technology, published in the United States and abroad, including *"Feeding Castings—A New Approach,"* appearing in the May AMERICAN FOUNDRYMAN.

Alfred John Murrer, a member of the A.F.S. Massachusetts Institute of Technology Student Chapter who graduated this June, is an engineer with the Gleason Works, Rochester, N.Y. Mr. Murrer left the Rochester Institute of Technology during the war to enter the Army Air Corps, and upon discharge entered M.I.T.

E. R. Jerome, Jr., formerly metallurgical assistant with the American Manganese Steel Division of the American Brake Shoe Co., recently resigned to accept a position with Grinnell Co., Inc., Providence, R.I. Holder of a degree of bachelor

A.F.S. CHAPTER DIRECTORY

BIRMINGHAM DISTRICT CHAPTER
Secretary-Treasurer, F. K. Brown, Adams, Rowe & Norman, Inc.

BRITISH COLUMBIA CHAPTER
Secretary-Treasurer, L. P. Young, A-1 Steel & Iron Foundry Ltd.

CANTON DISTRICT CHAPTER
Secretary, Robt. L. Fasig, Ashland Malleable Iron Co.

CENTRAL ILLINOIS CHAPTER
Secretary-Treasurer, Vern M. Swango, Caterpilla Tractor Co.

CENTRAL INDIANA CHAPTER
Secretary, Jack Giddens, International Harvester Co.

CENTRAL MICHIGAN CHAPTER
Secretary-Treasurer, George Petredean, Calhoun Foundry Co.

CENTRAL NEW YORK CHAPTER
Secretary, David Dudgeon, Jr., Utica Radiator Co.

CENTRAL OHIO CHAPTER
Secretary, D. E. Krause, Battelle Memorial Institute.

CHESAPEAKE CHAPTER
Secretary-Treasurer, C. A. Robeck, Gibson & Kirk Co.

CHICAGO CHAPTER
Secretary, V. M. Rowell, Velsicol Corp.

CINCINNATI DISTRICT CHAPTER
Secretary, B. A. Genthe, S. Obermayer Co.

DETROIT CHAPTER
Secretary, R. E. Cleland, Eastern Clay Products Inc.

EASTERN CANADA AND NEWFOUNDLAND CHAPTER
Secretary, J. G. Hunt, Dominion Engineering Works Ltd.

EASTERN NEW YORK CHAPTER
Secretary Treasurer, Ugo Navarette, General Electric Co.

METROPOLITAN CHAPTER
Secretary, J. F. Bauer, Hickman, Williams & Co.

MEXICO CITY CHAPTER
Secretary, N. S. Covacevich, La Consolidada S.A.

MICHIANA CHAPTER
Secretary-Treasurer, V. S. Spears, American Wheelabrator & Equip. Co.

NORTHEASTERN OHIO CHAPTER
Secretary, R. D. Walters, Werner G. Smith Co.

NORTHERN CALIFORNIA CHAPTER
Secretary, Charles R. Marshall, Chamberlain Co.

NORTHERN ILLINOIS-SOUTHERN WISCONSIN
Secretary, F. W. Thayer, Gunite Foundries Corp.

NORTHWESTERN PENNSYLVANIA CHAPTER
Secretary, H. L. Gebhardt, United Oil Mfg. Co.

ONTARIO CHAPTER
Secretary-Treasurer, G. L. White, Westman Publications Ltd.

OREGON CHAPTER
Secretary-Treasurer, Geo. C. Vann, Northwest Fdry. & Fce. Co.

PHILADELPHIA CHAPTER
Secretary-Treasurer, W. B. Coleman, W. B. Coleman & Co.

QUAD CITY CHAPTER
Secretary-Treasurer, C. R. Marthens, Marthens Co.

ROCHESTER CHAPTER
Secretary-Treasurer, L. C. Kimpal, Rochester Gas & Electric Corp.

SAGINAW VALLEY CHAPTER
Secretary-Treasurer, Raymond H. Klawuhn, General Fdry. & Mfg. Co.

ST. LOUIS DISTRICT CHAPTER
Secretary, P. E. Retzlaff, Busch-Sulzer Bros.-Diesel Engrg. Co.

SOUTHERN CALIFORNIA CHAPTER
Secretary, J. E. Wilson, Climax Molybdenum Co.

TENNESSEE CHAPTER
Secretary-Treasurer, A. D. Willis, U. S. Pipe & Foundry Co.

TEXAS CHAPTER
Secretary-Treasurer, P. B. Croom, Houston Pattern Works

TIMBERLINE CHAPTER
Secretary, John W. Horner, Jr., Slack-Horner Brass Mfg. Co.

TOLEDO CHAPTER
Secretary-Treasurer, R. H. Van Hellen, Unitcast Corp.

TRI-STATE CHAPTER
Secretary, D. A. Mitchell, Progressive Brass Mfg. Co.

TWIN CITY CHAPTER
Secretary-Treasurer, L. K. Polzin, Minneapolis Chamber of Commerce.

WASHINGTON CHAPTER
Secretary-Treasurer, A. D. Cummings, Western Foundry Sand Co.

WESTERN MICHIGAN CHAPTER
Secretary, D. A. Paull, Sealed Power Corp.

WESTERN NEW YORK CHAPTER
Secretary, F. J. Walsh, Hickman, Williams & Co.

WISCONSIN CHAPTER
Secretary, W. W. Edens, Badger Brass & Aluminum Fdry. Co.

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STUDENT CHAPTERS

UNIVERSITY OF MINNESOTA *Secretary,* Harvey Sauby

MISSOURI SCHOOL OF MINES *Secretary,* Martin L. Slawsky

OHIO STATE UNIVERSITY *Secretary-Treasurer,* Eldon Boner

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Secretary-Treasurer, Martin J. O'Brien

OREGON STATE COLLEGE
Secretary, John P. Meece

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of science in metallurgy from the Massachusetts Institute of Technology in 1944, Mr. Jerome had been with the Brake Shoe division since 1945.

Arturo Cardenas, formerly metallurgical engineer with La Consolidada S.A., Mexico City, has accepted a similar position with the Tezuitlan Copper Co., Aire Libre, Pue., Mexico. Mr. Cardenas is a graduate of Williams College and a member of the Mexico City Chapter of A.F.S.

OBITUARIES

Elliott R. Jones, 47, plant superintendent of the Lumen Bearing Co., Buffalo, N.Y., and immediate past chairman of the Western New York chapter of the American Foundrymen's Society, died May 29 at his home in Buffalo of a heart attack. Born in Aberdeen, Md., Mr. Jones attended St. Joseph's Collegiate Institute, Buffalo. Upon graduation, he joined the Lumen Bearing Co., where his father was plant superintendent. He left Lumen Bearing to join the Army and served on the Mexican border and in Europe during World War I. Upon his return, Mr. Jones rejoined Lumen Bearing and eventually succeeded his father as plant superintendent, a position which he had held for 10 years at the time of his death.

CHAPTER MEETINGS

AUGUST 21
WESTERN MICHIGAN
Pontaluna Golf Club
ANNUAL STAG PICNIC

CENTRAL MICHIGAN
Cascades Park, Jackson
SUMMER OUTING

CENTRAL OHIO
Columbus Riding Club
ANNUAL OUTING

ONTARIO
Estate of Rolph Barnes, Waterdown
ANNUAL PICNIC

SEPTEMBER 10
SOUTHERN CALIFORNIA
Rodger Young Auditorium, Los Angeles
B. L. SIMPSON
National Engineering Co.
"History and Development of the Castings Industry"

SEPTEMBER 11
ROCHESTER
Barnard's Exempt Firemen's Ass'n.
ANNUAL OUTING

NORTHWESTERN PENNSYLVANIA
Tieman's Grove, Erie
ANNUAL PICNIC

SEPTEMBER 14
N. ILLINOIS-S. WISCONSIN
Faust Hotel, Rockford
F. R. SNYDER
Hickman, Williams & Co.
"Control of Cupola Operation"

SEPTEMBER 18
BIRMINGHAM
Roebuck Country Club
ANNUAL BARBEQUE

CHAPTER ACTIVITIES NEWS

Central Illinois

V. W. Swango
Caterpillar Tractor Co.
Acting Secretary-Treasurer

THE SECOND ANNUAL CLAMBAKE STAG of the Central Illinois Chapter, held at Keeneland Park, northwest of Peoria, was attended by about 250 members and guests.

Features of the clambake, in addition to the clams, chicken and "trimmings," were a blind bogey golf tournament with prizes for 12 winners, soft ball games, and horseshoe pitching contests.

Central New York

John A. Feola
Crouse-Hinds Co.
Publicity Chairman

THE ANNUAL OUTING and Business Meeting of the chapter was held at Montour Falls, N.Y., June 16, with the Shepard-Niles Crane & Hoist Co., acting as host.

At the annual Business Meeting, the nominating committee's slate of officers was elected uanimously. In addition to the regular slate, the following committee chairmen were appointed: P. E. Kyle of Cornell University, to head the chapter's Educational Program; William A. Mader, Oberdorfer Foundries, to head the Non-Ferrous group, and John A. Feola, publicity chairman.

Retiring Chapter Chairman R. A. Minnear thanked all the members for their cooperation during his term in office, concluding the business meeting.

Following this, the members were conducted through the plant of the Shepard-Niles Co., to observe the various operations involved in the manufacture and assembly of cranes and hoists.

R. C. S. Potter, Chemung Foundry, Elmira, was chairman of the evening program, consisting of a social hour, buffet dinner and other social activities.

Sydney Buckley, president of the Shepard-Niles Co., and S. G. H. Turner, chairman of the board, welcomed members of the chapter on behalf of their company and explained its close alliance with the foundry industry.

Southern California

Leo N. Wood
Triplett & Barton, Inc.
Chapter Reporter

GRAND COULEE DAM, the world's largest structure, will have 12 of the world's largest pumps, according to the June 11 meeting speaker, Ira Morgan White, whose company, the Pelton Water Wheel Co., San Francisco, is making the pumps.

Grand Coulee, which is three times as large as the world's second largest structure, the largest of Egypt's pyramids, will have 12 valveless pumps of double-volute type combined with some turbine principles of construction.

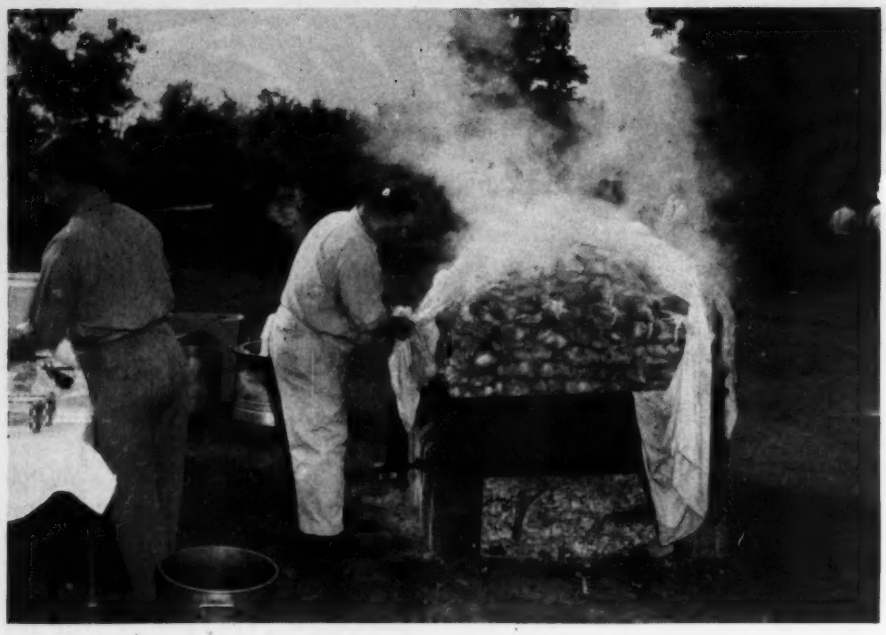
Each will be moved by a 65,000 hp electric motor. (The largest motor ever before built was 30,000 hp—in Europe). Current running the pumps will come from the dam generators. The pumps will lift Columbia River water some 300 ft in normal operation, and will be able to lift water up to 357 feet. The motors will run at 200 rpm.

Standards imposed on the construction of the pumps allow for only ¾ of 1 per cent variation in factors of efficiency, as laid down by the United States Bureau of Reclamation.

In many cases, Mr. White said, foundry facilities have been instrumental in dictating the type of design that has been employed for the pumps. Foundry work for the runner, which will weigh 70,000 lb, entails melting of 98,000 lb of metal.

The June meeting in Los Angeles was highlighted by the transfer of the Chapter President's gavel to Leonard O. Hoffstetter, Brumley-

Dale Hall, Oklahoma Steel Castings Co. (standing, left), newly-elected chairman of the Tri-State Chapter, receives gavel symbolizing chairmanship from Retiring Chairman R. W. Trimble, Bethlehem Supply Co. Onlookers at the speakers' table at the Chapter's Annual Stag Party are, left to right, Director C. C. Beagle, The Webb Corp.; Vice-Chairman C. A. McNamara, Jr., Big Four Foundry Co., Inc.; and Director James K. Winger.



Central Illinois Chapter's "chef" prepares a huge mound of steamed clams at the Chapter's second annual Clambake, at Keeneland Park, near Peoria.

Donaldson Co., by outgoing President Henry E. Russill, Eld Metal Co., Ltd., who received a diamond ring from the chapter members in token of appreciation for his services. At the same meeting, chapter committeemen took office.

Chesapeake

J. H. Schaum
National Bureau of Standards
Chapter Reporter

SAND GRAIN DISTRIBUTION was the subject of the principal address of the final meeting of the season, given by Clyde A. Sanders of the American Colloid Co., May 28, at the Engineers' Club, Baltimore.

A full program included two speakers in addition to Mr. Sanders —Maj. You Cheng Tsau of the Chinese Air Force, who discussed Chinese customs, and Dr. D. C. Williams of Ohio State University, who stressed the importance of having top foundry executives interview college graduates and to offer an adequate training program if they intend to induce promising young men into the industry.

Mr. Sanders illustrated his talk on sand grain distribution with a series of test tubes containing the sand retained on each screen of a set of standard sieves. The speaker showed the grain distribution of a number of sands in commercial use and described their foundry properties. Interest in the subject was apparent from the discussion period.

It was announced that the Norfolk Naval Yard will be host to the Chapter in September.

Ontario

Alvin E. Bock
Standard Castings & Mfg. Co.
Chapter Reporter

CHAPTER DIRECTORS and the Program Committee met jointly at the Royal York hotel, Toronto, on the night of July 6, under the chairmanship of Russell A. Woods, Geo. F. Pettinos Co., Hamilton.

Mr. Woods and J. H. King, Werner G. Smith Co., Toronto, vice-chairman of the Ontario Chapter, reported in detail on information, instructions and suggestions received at the recent Chapter Chairman Conference meeting in Chicago. This meeting was a real inspiration and will be of great value to the chapter.

T. Davies, Canada Metal Co., Toronto, was appointed chapter publicity chairman, whose duty it will be to publicize meetings, speakers and topics to the membership.

The program for the coming year, including meeting chairmen, speakers and their topics, was thoroughly discussed and an interesting and instructive season is assured. The first meeting will be held in Hamilton on September 17, when foreman training will be discussed.

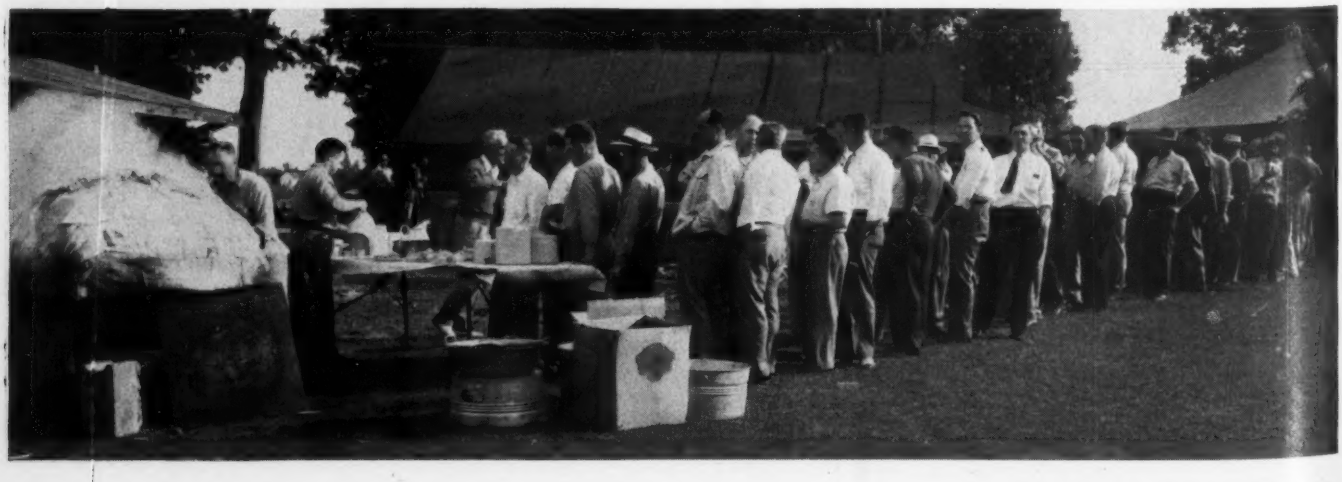
Other chapter business, such as alternate speakers, picnic arrangements for August 21 at Barnsdale, and a report on the May Annual Meeting and Entertainment Night, was discussed.

Quad City

C. R. Marthens
Marthens Co.
Secretary-Treasurer

APPROXIMATELY 200 MEMBERS of the Quad City Chapter attended the Annual Stag Outing June 19. Held at Camp Nobel, on the Rock

Hungry foundrymen form a "chow line" at Central Illinois Chapter's Annual Clambake.



Standing in front of elaborate floral A.F.A. symbol at a recent meeting of the Mexico City Chapter are, left to right, newly-elected Chapter President F. Gonzales Vargas, meeting guest W. B. Coleman, W. B. Coleman & Co., Philadelphia Chapter secretary, and Past President Manuel Goicoechea.

River near Moline, Ill., the outing started with golf at the Short Hills Country Club.

A chicken supper followed an afternoon of outdoor sports and there was a floor show in the evening. C. L. Briceland, J. I. Case Co., Bettendorf, Iowa, headed the committee for the outing.

Mexico City

N. S. Covacevich
La Consolidada S. A.
Chapter Secretary

PAST PRESIDENT Manuel Goicoechea was honored by members of the Mexico City Chapter at a dinner June 25. Appreciation was shown for the tireless efforts on behalf of the chapter which Mr. Goicoechea made, notwithstanding the fact that as general manager of Fundiciones de Hierro y Acero S.A., Mexico's most modern steel foundry, he has been very busy getting the plant started.

W. B. Coleman, president of W. B. Coleman & Co., Philadelphia, and secretary-treasurer of the Philadelphia Chapter, was a guest.

Chesapeake

J. H. Schaum
National Bureau of Standards
Chapter Reporter

BRONZE PRESSURE CASTINGS was the subject of an address by Clyde Frear, Bureau of Ships, Washington, D.C., at the April meeting.

The speaker explained that the chief cause of leakage is interdendritic shrinkage, recognizable by the presence of distinct dendrites in the fractured surface. This type of shrinkage may be prevented by keeping the riser open to atmospheric pressure through use of a gypsum insulating riser sleeve, exothermic riser compounds, or induction heating of the riser.

Low pouring temperatures minimize dendrite growth and thereby aid casting soundness, he added, and recommended improving the quality of bronze castings by (1) using gas-free materials, (2) melting under oxidizing conditions, (3) avoiding overheating, (4) preheating ladles, (5) pouring at low temperatures, and (6) designing for directional solidification and complete feeding.

The following is excerpted from technical minutes of the meeting taken during Mr. Frear's lecture:

The term "tin bronze" is used to define those copper-base alloys containing 2 to 20 per cent of tin with zinc less than tin, and with lead less than 0.5 per cent. Because of specific properties and similar response to variables in foundry technique, the leaded tin bronzes, high-leaded tin bronzes, red brasses and leaded red brasses are included in this category of bronze alloys.

Interdendritic shrinkage is the chief cause of leakage in a bronze pressure casting. An examination of the discoloration of the surface of a fracture of a casting will determine the presence and extent of this type of shrinkage. If the fracture, examined under a low-power microscope, contains distinct dendrites, there is a shrinkage present. If the fracture is finely granular, with no traces of dendrites and the color is a yellowish gray with a bluish tinge, there is no shrinkage present.

The longer the dendrite is in contact with the molten metal, the larger the dendrite will tend to grow. The more dendrites that grow, the smaller they will be.

The higher the pouring temperature, the longer the time for dendritic growth. At the lowest pouring temperature possible, the time is less for dendritic growth and the casting is sounder.

Texas

W. H. Lyne
Hughes Tool Co.
Publicity Chairman

CUPOLA OPERATION and carbon control was the subject of an address by W. W. Levi, Lynchburg

Retiring Chapter Chairman H. E. Russill presents sports trophy to the Southern California Chapter Bowling League Champions. Left to right: C. Faust, H. E. Russill, W. G. Davenport, D. Faust, O. Walling and W. Klick.

Retiring Chairman H. E. Russill, Eld Metal Co., Ltd., (right) hands over Southern California Chapter's gavel and bell to Incoming Chairman Leonard Hoffstetter, Brumley-Donaldson Co. H. McGraw is the onlooker.

Foundry Co., Lynchburg, Va., before the May meeting.

Mr. Levi recommended the use of kindling tuyeres and a layer of flux on the cupola bed to insure hot iron at the start of a heat. Limestone and fused soda ash on the bed provide a fluid slag which will start running soon after tapping out.

Mr. Levi stressed the fact that carbon in the charge is most important and should be calculated from the weighed and previously analyzed materials which make up the charge. The carbon in the iron at the spout, he said, should be determined by analysis. In addition to being affected by the ingredients of the charge, the carbon at the spout is affected by the amount and type of coke in the bed and between charges.

It is also affected by the melting rate and temperature of the blast. The moisture content of the air in the blast affects the temperature of the blast, which in turn results in a bath temperature difference, Mr. Levi concluded.

Eastern New York

D. B. Slater
General Electric Co.
Publicity Chairman

APPROXIMATELY 100 MEMBERS and guests attended the May meeting, held at the Circle Inn, Lathams Corners, May 18.

National Director John M. Robb, Jr., Hickman Williams Co., Philadelphia, opened the meeting with a brief address, in which he outlined A.F.S. activities and extended greetings to the Chapter from National President-Elect William B. Wallis and other National Officers.

Vice-Chairman A. C. Andrew introduced the technical speaker of the evening, Vaughan C. Reid, vice-president, City Pattern Foundry & Machine Co., Detroit.

Mr. Reid spoke on "Patterns for High Production", citing the problems of this phase of the foundry industry. He illustrated his lecture with lantern slides.

The Nominating Committee presented the following slate of officers for 1948-49:

Chairman, A. C. Andrew, American Locomotive Co.;*vice-chairman,* K. Echard, Eddy Valve Co., *secretary-treasurer,* U. Navarette, General Electric Co.

Directors (three years) :P. Wilson, Hunter Machine Co., R. Garrison, Adirondack Steel Co.; and R. DeVarennes, Rensselaer Valve Co.

Directors (two years): L. Nelson, Ludlow Valve Co.; J. Wheeler, Wheeler Brass Co.; and L. Scully, Scully Brass Co.

Directors (one year), Scott McKay, Rensselaer Polytechnic Institute; T. Carlson, General Electric Co.; K. Mason, Albany Casting Co.

Massachusetts Institute of Technology

L. M. Diran
Technical Secretary

PROMINENT GUESTS from the foundry industry present at the May 13 meeting of the MIT Student Chapter included W. G. Mixer, general superintendent, Buick Foundry, Flint, Mich.; George K. Dreher, executive director, Foundry Educational Foundation, Cleveland; Donald E. Whitehead, consulting engineer; and R. H. Harrington, Hunt-Spiller Mfg. Co., Boston.

Chairman Gerald Grott called upon Chapter members who have already visited the sites of their summer jobs in the foundry to tell of their experiences during these visits. He in turn told of his trip to the recent A.F.A. Convention in Philadelphia, and of what was said there concerning the opportunities for young men in the foundry.

Mr. Dreher, speaking in the in-

Winners of the Wisconsin Chapter's Apprentice Contest posed for this photograph at the Chapter's recent Old Timers' and Apprentices' Night.

These "old timers" are part of a group of 30 veteran foundrymen awarded pins in recognition of 50 years' service at the Northern Illinois-Southern Wisconsin Chapter's "Old Timers' Night," held recently in Beloit, Wis.

terests of both the students and their prospective employers, gave the students a few tips on what to expect and what will be expected of them upon their entrance into the foundry industry.

The principal speaker of the evening, W. G. Mixer, described the design, construction and wartime operation of the huge Buick foundry at Flint, Mich. Starting with the decision of the company to build this unit, Mr. Mixer traced every succeeding step. By means of slides, he showed the plant layout arrived at after intensive study of other foundries throughout the country. This layout is unique in many ways. There were four main production lines arranged as completely independent units to enable castings in any quantity to be made profitably by cutting labor and burden costs in the event of a cut in production quotas. The flow of production in each unit was designed so that there is no crossing over or backtracking from the time the sand is brought in until the castings are ready for shipment.

All supplies are kept in the basement of the plant and brought up to the main floor on elevators as needed. This eliminated all trucking on the main floor and minimized confusion and interference with actual production.

At every point efforts were made to eliminate heavy work, improve working conditions, and speed up production. This was accomplished by the use of lightweight patterns, flasks, and core boxes specially designed for quick handling; roll type and hook type conveyors; an efficient ventilating system; and specially-designed apparatus such as the new multi-position device for easy handling of cylinder heads during cleaning.

This was the last meeting of the Chapter until October, due to the coming summer recess, when many of the Chapter's members will be working in foundries throughout the country.

Central Indiana

W. K. Mitchell
L. W. & W. K. Mitchell Co.
Chapter Reporter

PRODUCTION RHYTHM — Man to man, an address by Dr. Ralph L. Lee of General Motors Corp., was the outstanding feature of the May 24 meeting at the Athenaeum, Indianapolis. This was the final meeting of the year and results of elections of Chapter officers for the coming year were announced.

In his address, Dr. Lee made a strong plea for greater understanding between management and labor in the foundry industry. He pointed out that too often the executive is prone to forget the difficulties and the problems encountered by the molder.

Dr. Lee urged that every foundry executive spend more time in the foundry and that stronger incentives be offered the foundry worker in order to get improved production from him. He made it clear that unless the foundry worker is taken into the confidence of management, shown the goal toward which he is striving and the finished job on which he is working, he cannot be expected to take much of an interest in his job or to produce at capacity.

William B. Ziegelmueller, retiring Chapter chairman, pointed out that the Central Indiana Chapter is now the fourth largest in the country, and reviewed the progress of the Chapter since its beginning in 1939 with a membership of only 40, to its present membership of approximately 400 foundrymen.

Western Michigan

D. A. Paull
Sealed Power Corp.
Chapter Secretary

THE LAST MEETING OF THE SEASON was held Monday, May 10, at the

(*Continued on Page 84*)

L. E. Roby (left) Peoria Malleable Castings Co., technical chairman of the Central Illinois Chapter, confers with J. A. Durr, Albion (Mich.) Malleable Iron Co., who spoke to the group on malleable foundry practices.

NEW Foundry Products

Readers interested in obtaining additional information on items described in New Foundry Products should send requests to Reader Service, American Foundryman, 222 W. Adams St., Chicago 6, Ill. Refer to the items by means of the convenient code numbers.

Die-Less Duplicator

AU1—The Di-Acro Punch, developed by the O'Neil-Irwin Mfg. Co. is a double purpose machine capable of rapidly perforating holes of various shapes and sizes as large as 4" diameter, and can be used

as a precision punch for an unlimited variety of blanking, drawing, embossing and forming operations. Roller bearing cam converts a small amount of operator effort into tremendous pressure at point of impact. Punch head is positively controlled to insure perfect alignment at all times. A wide variety of interchangeable punches are available in round square, oval and rectangular shapes.

Bantam Bin-Dicator

AU2—A smaller type of Bin-Dicator, the Bantam, designed for use on very small hoppers, spouts, chutes and conveyors, has only a 5-¾ in. overall diameter. Bin-Dicators are diaphragm-operated switches in sealed housings which mount on the outside of bins, hoppers, etc., and signal changes in material levels. They automatically start and stop filling and emptying equipment as the level of material reaches designated limits.

Metal Lacquer

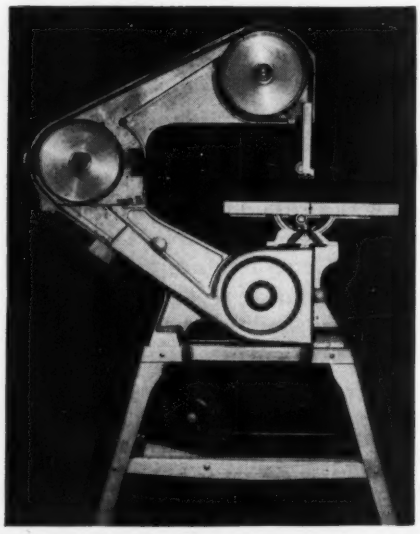
AU3—An oil-resistant metal lacquer, developed by the Dennis Chemical Co., can be used where oil resistance, toughness and maximum adhesion are required. No 5062 lacquer will withstand 24-hr immersion in gasoline and 15 min immersion in hot oil with no apparent deterioration in film strength or gloss. Coating has excellent adhesion to a variety of metal surfaces. Complete line of colors is available.

Interior Enamel

AU4—A fast drying, washable, extremely white enamel is announced by the Vitavar Corp. The whiteness of the enamel eliminates eye strain and reduces accidents by reflecting ample light to working surface and traffic areas. Non-yellowing reflecting surface retains its faculty for light reflection over long periods of time. The enamel resists moisture, gases and ordinary fumes. Finishes: gloss, semi-gloss, flat, undercoat and primer sealer.

3-Wheel Band Saw

AU5—A three-wheel utility band saw is offered to the foundry and pattern shop trade by the Owen Pattern & Foundry Co. The unique features of the Owen saw—the wide 18¼ in. throat from blade



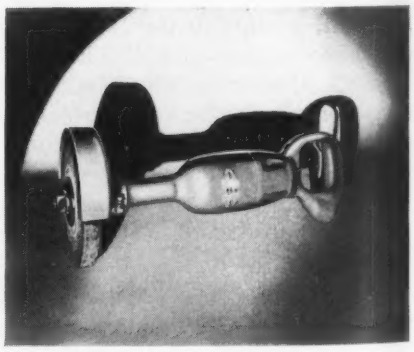
to frame, and the 30° inside tilt and the 45° outside tilt of the work table—are designed to fill the present gap between big saw operations and the limited facilities offered by smaller saws. The Owen saw, operating on a ½ hp motor, develops a blade speed of 3200 fpm, and cuts equally well on wood up to 8 in. thickness, nonferrous metals up to 2½ in. thickness and plastics, all without the necessity for blade or speed change when changing from one material to another. Skip-tooth cutting blade, traveling a three-wheel circuit, runs in an enclosed channel, thus maintaining positive blade control and enabling a greater degree of pressure to be brought to bear without the possibility of blade skid. Vibration has been eliminated by placing wheels an inch from the torque line of the frame. Other features: sealed precision bearings, positive table lock, oblique bend of saw blade and traverse, cast aluminum construction, compact and lightweight. Manufacturer estimates the Owens saw will do 75 per cent of the work of a big saw. Available in both floor and bench models.

Heat Fatigue Drops

AU6—Benson Heat Fatigue Drops differ from other heat cramp preventatives, such as salt tablets, in that they contain not only sodium chloride but two other body salts in approximately the same proportions as they are lost in perspiration. In addition, Fatigue Drops are made in special butterscotch candy form and are pleasing to the taste. The drops are individually wrapped in convenient form. It is estimated that the average employee will require six pieces daily, costing slightly more than 2 cents per employee per day. Samples available upon request.

Pneumatic Tools

AU7—A newly-designed group of pneumatic tools, known as the Stream-Power line has been introduced by the Buckeye Tools Corp. The new line comprises horizontal grinders ranging in speed from 3000 to 22,000 rpm, weighing 1 to 12 lb, with capacities from ½ in. to 8 in. diameter; vertical grinders and sanders with speeds from 3000 to 6000 rpm, weighing from 10 to 12 lb, with grinding wheel capacities



from 4 in. to 6 in. diameter and sanding pad capacities from 5 in. to 9 in. diameter. Features include less weight, better balance, compact size, quiet operation, increased power, simplified maintenance, governor control, direct air flow, and ease of lubrication.

Pulley Lagging

AU8—An entirely new, all-purpose waterproof pulley lagging that can be quickly and easily applied without rivets,

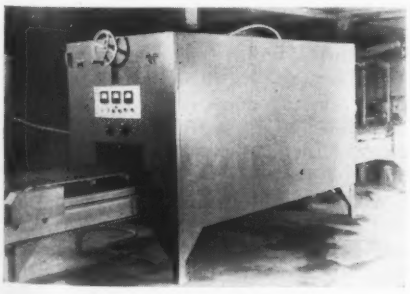
bolts, or heat, Condersite Engineering Co.'s lagging dries within 10 hours at room temperature. The lagging adheres so firmly to all surfaces that a hammer and chisel are required to remove it. The lagging is weather and corrosion resistant, unaffected by sulphuric acid, oxidizing agents, soaps, alcohol or petroleum agents. When dry it is odorless, non-toxic and non-inflammable. May be ordered in units of 70 x 40 in. treated fabric and sufficient compound for application, in any size.

Elevator Bucket

AU9—A new type of elevator bucket, featuring an independent ejector plate, capable of dislodging such adhesive, sticky, bonded materials as foundry sands, etc., has been developed by the Pekay Machine & Engineering Co. The ejector plate serves as the back of the bucket but is attached to the elevator belt by an entirely separate mounting than that used for the bucket itself. The passing of this mounting over the radius of the head pulley moves the ejector plate in a strong sweeping action, irresistibly dislodging contents of the bucket. With "every time emptying" elevators can be counted on for controlled capacity, thus increasing efficiency as much as 30 per cent over conventional type buckets. Buckets are available in either special or standard sizes, with or without reinforcement lip. Can be easily substituted for other types of buckets on any elevator without major change to the elevator itself, utilizing standard hole punchings.

Core Baking Tunnel

AU10—Model M-800A Ther-Monic Electronic Core Baking Tunnel, has an average baking cycle of only a few minutes and a capacity of 650 lbs of cores per hour. The Model M-800A will produce a ton of baked cores at a power cost of 92 cents. Electronic heating times in the order



of from 20 seconds to a few minutes permit cores to be baked as they are needed in the pouring room and changes in molding times to be effected regardless of what cores are in stock. Green cores may be loaded directly onto the Ther-Monic Tunnel Conveyor, eliminating all racking and much of the handling of cores in the green state. No cooling period is involved after baking cycle, thus cores are ready for immediate inspection and use. Other benefits of electronic core baking: ready adjustment and control of green strength, hot strength, hardness, collapsibility and other characteristics of cores; reduces gassing; reduction of mulling time; finer surface finish; reduces number of dryers by 90 per cent; negligible shutdown and startup losses; no heat given off to surrounding atmosphere. Model M-800A is a continuous conveyor type, self-contained, compact unit 16'9" long, 4'4" wide and 6'8" high.

Portable Shop Crane

AU11—A 2000-lb capacity portable shop crane, the Hydro Lift, with a 45 in. boom to make installing or moving of shop equipment easy, is now available from the Cardinal Corp. Double-acting hydraulic pump converts every movement of pump handle into lift motion. Crane will not leak and holds load at any height. Fabricated of formed steel, the shop frame provides a stable platform for heavy loads. Rubber tired roller bearing wheels permit loads to be moved quickly and easily. Placing towing handle in upright position automatically sets brake and prevents crane from moving when lowering or hoisting heavy loads.

Photo Blackboard

AU12—Photographs of charts or similar subjects are blown up to giant size, coated with a material that permits writing or

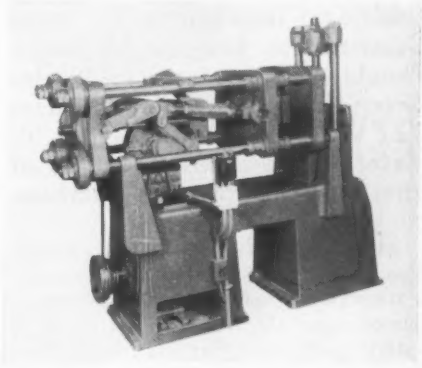
drawing on the enlargement with a colored pencil, to form a photographic "blackboard", which can be easily erased with a damp cloth. Eraso Prints, developed by Rapid Copy Service, have many applications in the metals industry. Demonstrating technical and clerical operations, new products demonstrations, graphs, flow charts and sales and advertising campaigns are a few of the many uses. Eraso Prints are furnished from your film negatives or copy in sizes from 30 x 40 in. to 40 x 70 in., mounted on substantial long wear wallboard. Special pencil furnished with each print.

Disc Grinder

AU13—A 24-inch Master Disk Grinder, designed for efficient sanding or grinding of metals, wood and plaster, has been developed by the Kindt-Collins Co. The disc grinder is made vibrationless through accurate balancing, which permits precision grinding, and is quickly and easily adjustable by means of a counterbalanced table, which can be moved up or down 11 in. by hand pressure to any desired position. A distinctive feature of the grinder is the reversible disc for right or left hand jobs. A 5 in. hole in the back of the machine permits attachment to a house suction system or dust collector. K-C Master Dust Collectors are available for use with the grinder.

Die Casting Machine

AU14—A larger hydraulic model of the Workhorse fully automatic die casting machine is announced by Light Metal Machinery, Inc. Model No. 32 HZ is designed for zinc, tin or lead production.



Shot capacity is 32 oz. Top speed is 720 shots per hour. Other speeds are 520, 340, 240. Casting cycle is completely automatic. Die movement, shot and rejection follow smoothly in continuous repetitive cycles. After operator sets machine, there is no human element in determining hourly output. Between-cycle delays are eliminated. Single cavity dies can be used to cut die costs. Delivered complete with Vickers hydraulic control unit.

Four Wheel Bandsaw

AU15—Designed for trimming flashings and for high speed cut-off of gates and sprues on nonferrous castings, a four-wheel bandsaw with exceptional throat depth is now in production at the T. Farrell Machine Co. Cutting capacity of the saw is 27 in. x 12½ in.; and the 18 in. x 24 in. table tilts 45° right or 10° left. An auxiliary table 16 in. x 18 in. is furnished. The four wheels are 12 in. in diameter and the machine uses blades 10 ft. 4 in. in length and from ⅛ in. to 1 in. in width. Blade speeds in the standard model are 550,1050, 1750 and 2700 fpm. A low speed model with gear drive offering speeds starting at 65 fpm is available. Sealed factory anti-friction bearings are used throughout the machine. Base and table castings are gray iron; guard castings are aluminum. Sealed ball bearing saw guides.

Reflectoscope

AU16—A simplified version of the Sperry Type SRO4 Supersonic Reflectoscope has been developed by Sperry Products, Inc., and is available at lower cost than previous models. With the Reflectoscope it is possible to find small defects at depths up to 10 ft. Cracks, voids, laminations and other defects are accurately located in castings or in assembled machinery. Bulletin No. 3001 is available.

(*Continued on Page 83*)

FOUNDRY Literature

Readers interested in obtaining additional information on items described in Foundry Literature should send requests to Reader Service, American Foundryman, 222 W. Adams St., Chicago 6, Ill. Refer to the items by means of the convenient code numbers.

AU101—R. Lavin & Sons, Inc., Chicago, announces that readers of AMERICAN FOUNDRYMAN may have their names placed upon the free mailing list of its quarterly technical publication, *The Lavingot*, upon request. *The Lavingot* each issue features outstanding articles on nonferrous founding, some of them written especially for the publication by authorities on the subject, and others reprinted from leading metals technical and trade magazines. Other features of various issues are question and answer panels on nonferrous founding problems and brief news items of interest to foundrymen. Readers desiring to be placed on the mailing list of *The Lavingot* are requested to write on a business letterhead.

AU102—Bulletin No. 101, recently issued by the General Cerium Co., describes the properties and applications of cerium metal (Mischmetal). Listed are the average chemical composition of the metal, forms in which it is supplied, and its advantages in the casting of iron, aluminum, bronze, copper and magnesium. The four-page booklet is available free of charge.

AU103—A 22-page, handsomely-illustrated booklet published recently by the Powermatic Ventilator Co., describes the "Iron Lung" industrial ventilation system and its applications to foundries. Designed specifically for the foundry industry, the booklet includes several large photographs showing "Iron Lung" installations in some of the nation's leading foundries. Also included are a description of the outstanding features and applications of the "Iron Lung," dimensions and specifications and a listing of hundreds of foundry users throughout the nation.

AU104—A pocket guide to Airco arc welding electrodes presents all facts pertaining to the most commonly used electrodes, plus helpful data regarding factors to be considered in choosing electrodes for specific jobs. Available gratis from the Air Reduction Sales Co., the illustrated 4x8 in. guide is thumb-indexed for ready reference and contains a NEMA Standard Color Chart, an electrode selection table and comparison chart, and complete descriptions, recommended applications and welding procedures for all electrodes.

AU105—Bulletin 124-B, describing Hewitt-Robbins, Inc.'s shakeouts and other products for the foundry industry, is designed to replace Bulletin 124-A in the vibrating machinery section of the Robbins bulletin binder. Bulletin 124-B contains additional information on the current trend toward foundry mechanization, and pointers on shakeout selection.

AU106—A "planning guide for production people concerned with heat treating, baking or curing problems" is announced by Gehnrich & Gehnrich, Inc. under the title "How to Select the Right Oven for Your Process." The 32-page, illustrated booklet includes 43 drawings and diagrams, 23 photographs and oven selection tables.

AU107—A pamphlet, "The Most Valuable Advertising Space You Can Use," available from the American Name Plate Co., explains the function, design, production and selection of name plates. Information on design, lettering, shapes, sizes, metals, colors and finishes is given.

AU108—Several bulletins recently published by the Whiting Corp. and available free of charge include: (FY-153) Whiting Mechanical Chargers, 36 pp., illustrated. Discusses nine methods of mechanical charging. (FY-152) Cupola Spark Suppressor. Describes an efficient spark and cupola fume suppressor. (FY-154) Whiting Impact Pulverizer. Gives full information on sizes, capacities, etc., of the Whiting line of impact pulverizers. (FY-155) Whiting-Cole Annealing Oven. Describes the Company's circulating fans and water cooling coils. (FY-156) Whiting "CH" Dust Suppressor. Describes new wet-type dust suppressor shown at this year's Foundry Congress in Philadelphia.

AU109—A booklet describing the American Air Filter Co.'s furnace hood to be used in combination with the Type N Roto-Clone dust collector shows detailed photographs of the hood, which can be varied to fit any make of furnace, to control dust and smoke.

AU110—Copies of an article printed in a recent issue of *Oakite News Service*, house publication of Oakite Products, Inc., on *"Cleaning Iron Castings by Wet Mill and Hydro Blast"* are available free of charge. The article briefly reviews the cleaning of castings by sandblasting and dry rattling or dry tumbling, and compares them with the wet-mill and hydro-blast methods.

AU111—A four-page folder describing the properties and advantages of Kaylo Heat Insulating Block is being released by the American Structural Products Co. Kaylo was introduced at the beginning of the war and was used in ships, "hot process" plants and other installations vital to the war effort. This strong mineral insulation is produced on a mass production basis for peacetime applications.

AU112—Service bulletins describing Thor sand core binders and other foundry products, published by the Borden Co., Chemical Division, are available on urea resin binders, phenol resin binder, green binder, liquid parting, core and mold hardener, humectant, white core paste, air-drying paste and Thor pattern casting resin. The bulletins cover advantages, properties and suggestions for use.

AU113—Copies of Allis-Chalmers Manufacturing Co.'s *1947 Annual Review*, available on request, present a review of the Company's recent engineering developments for use in such industries as metals, power, rock products, coal, petroleum, construction, food, and transportation. 32 pages, illustrated.

AU114—"This Little Pig Went to Market" is a unique pamphlet graphically describing the story of Jackson Iron and Steel Co.'s Jisco Silvery Pig Iron. Ore sources, air conditioning and fuels that go into the makeup of Jisco Pig Iron are shown and a chemical analysis of the product and a formula for a typical gray iron cast charge are given.

AU115—Designed for use by plant managers, foreman, service men and others whose problems embrace the purchase and maintenance of materials handling systems, Gould Battery Co.'s two six-page technical brochures contain illustrations, descriptions and technical data on industrial truck batteries. Included is an "exploded" view showing every construction feature of the Gould "Thirty" battery and explaining a glass tape feature

(Continued on Page 95)

NEW PRODUCTS

(Continued from Page 79)

Sludge Solvent

AU17—A sludge and gum solvent for use in hydraulic equipment, developed by the Swan-Finch Oil Co. and known as Hydro-Solve "A," can be added to regular hydraulic oils to remedy any sluggish operation caused by contaminants. Solvent is put into oil for 100-150 working hours, drained and new oil put in. There is no necessity for cleaning the system after using—simply refill and resume production. Hydro-Solve "A" is a liquid concentrate composed of several highly-active organic gum and sludge solvents, is non-corrosive and will not affect fine surface finishes, the manufacturer states.

Small Dust Collector

AU18—A line of small, portable, self-contained dust collectors with air capacities ranging from 550 to 1350 cu ft of air per min is announced by Parsons Engineering Corp. The "Gem" units are available in four sizes and designed to be set close to the source of dust by merely attaching pipe or flexible tube to collector inlet. Applicable for filtering and collecting practically all industrial dust. Units prevent heat loss by returning filtered air to the room. This completely-packaged product is recommended specifically for use where no central dust collecting system is available and where the air volume for proper handling of a dust problem is relatively small.

Metatarsal Arch Guard

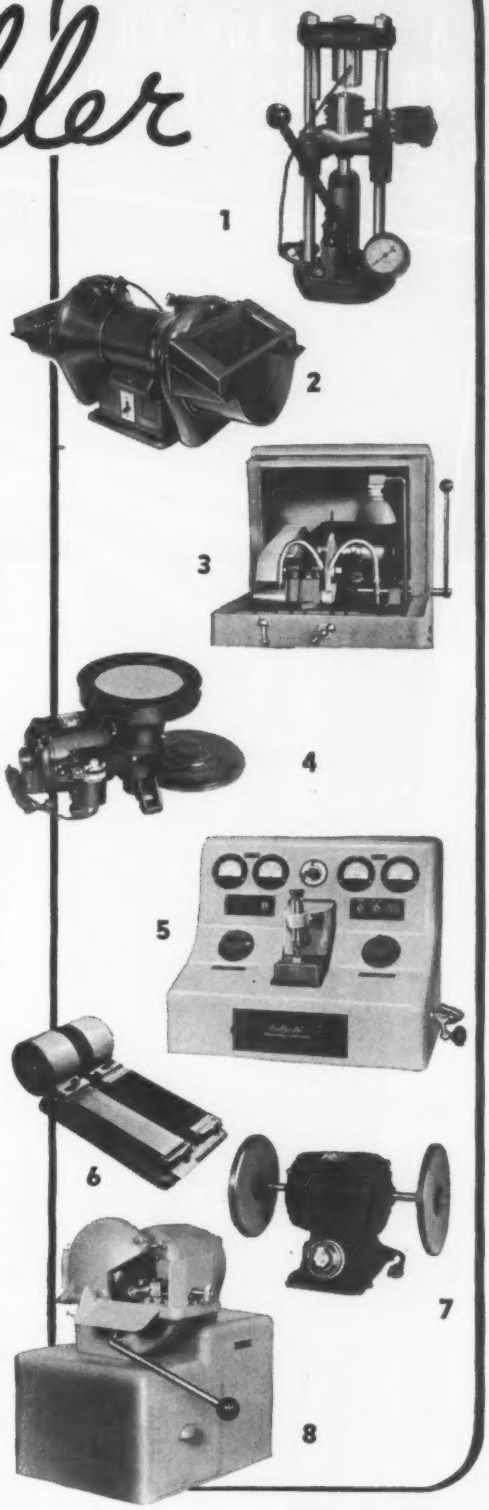
AU19—Constructed of 20 gauge steel and made in a range of four sizes to fit any shoe size comfortably, Trinal Inc.'s new development, Safeet, protects the metatarsal arches from foot hazards. Ribbed and reinforced arch affords protection by distributing the potential impact over two widely separated bearing surfaces, i.e., a steel bar that fits shoe forward of the shoe heel, and a steel toe cap incorporated in the safety shoe.

Strength Deformation Recorder

AU20—Easily attachable to the Universal Sand Strength Machine, a strength deformation recorder developed by the Harry W. Dietert Co. may be used for either the green compressive strength test on the A.F.S. 2" x 2" sand specimen or for the A.F.S. core transverse strength test. The recorder draws the stress-strain diagram on a chart ruled to show psi, compressive strength or load in lbs for core transverse strength. Deformation is measured on horizontal axis with a ruler reading to 0.001" deformation in the case of the compression test and 0.001" deflection in the case of the baked core transverse test. Recorder, accurate to within 0.0005", is driven by a synchronous motor normally in an electric braked position. Deformation or deflection of test specimen releases brake, causing recording pen to traverse right or left. Changes in bending or length are thus recorded. May be used to measure load carrying ability and amount of deflection of a baked core.

Buehler

Offers a Complete Line of Equipment for the . . . METALLURGICAL LABORATORY



Buehler specimen preparation equipment is designed especially for the metallurgist, and is built with a high degree of precision and accuracy for the fast production of the finest quality of metallurgical specimens.

1. No. 1315 Press for the rapid moulding of specimen mounts, either bakelite or transparent plastic. Heating element can be raised and cooling blocks swung into position without releasing pressure on the mold.

2. No. 1211 Wet power grinder with ¾" hp. ball bearing motor totally enclosed. Has two 12" wheels mounted on metal plates for coarse and medium grinding.

3. No. 1000 Cut-off machine is a heavy duty cutter for stock up to 3½". Powered with a 3 hp. totally enclosed motor with cut-off wheel, 12" x 3/32" x 1-1/4".

4. 1505-2AB Low Speed Polisher complete with 8" balanced bronze polishing disc. Mounted to ¼ hp. ball bearing, two speed motor, with right angle gear reduction for 161 and 246 R.P.M. spindle speeds.

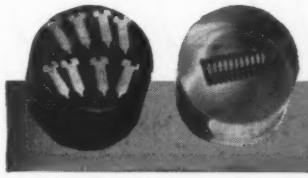
5. No. 1700 New Buehler-Waisman Electro Polisher produces scratch-free specimens in a fraction of the time usually required for polishing. Speed with dependable results is obtained with both ferrous and non-ferrous samples. Simple to operate—does not require an expert technician to produce good specimens.

6. No 1410 Hand Grinder conveniently arranged for two stage grinding with medium and fine emery paper on twin grinding surfaces. A reserve supply of 150 ft. of abrasive paper is contained in rolls and can be quickly drawn into position for use.

7. No. 1400 Emery paper disc grinder. Four grades of abrasive paper are provided for grinding on the four sides of discs, 8" in diameter. Motor 1/3 hp. with two speeds, 575 and 1150 R.P.M.

8. No. 1015 Cut-off machine for table mounting with separate unit recirculating cooling system No. 1016. Motor 1 hp. with capacity for cutting 1" stock.

The Buehler Line of Specimen Preparation Equipment includes . . . Cut-off Machines • Specimen Mount Presses • Power Grinders • Emery Paper Grinders • Hand Grinders • Belt Surfacers • Mechanical and Electro Polishers • Polishing Cloths • Polishing Abrasives.



Buehler Ltd.

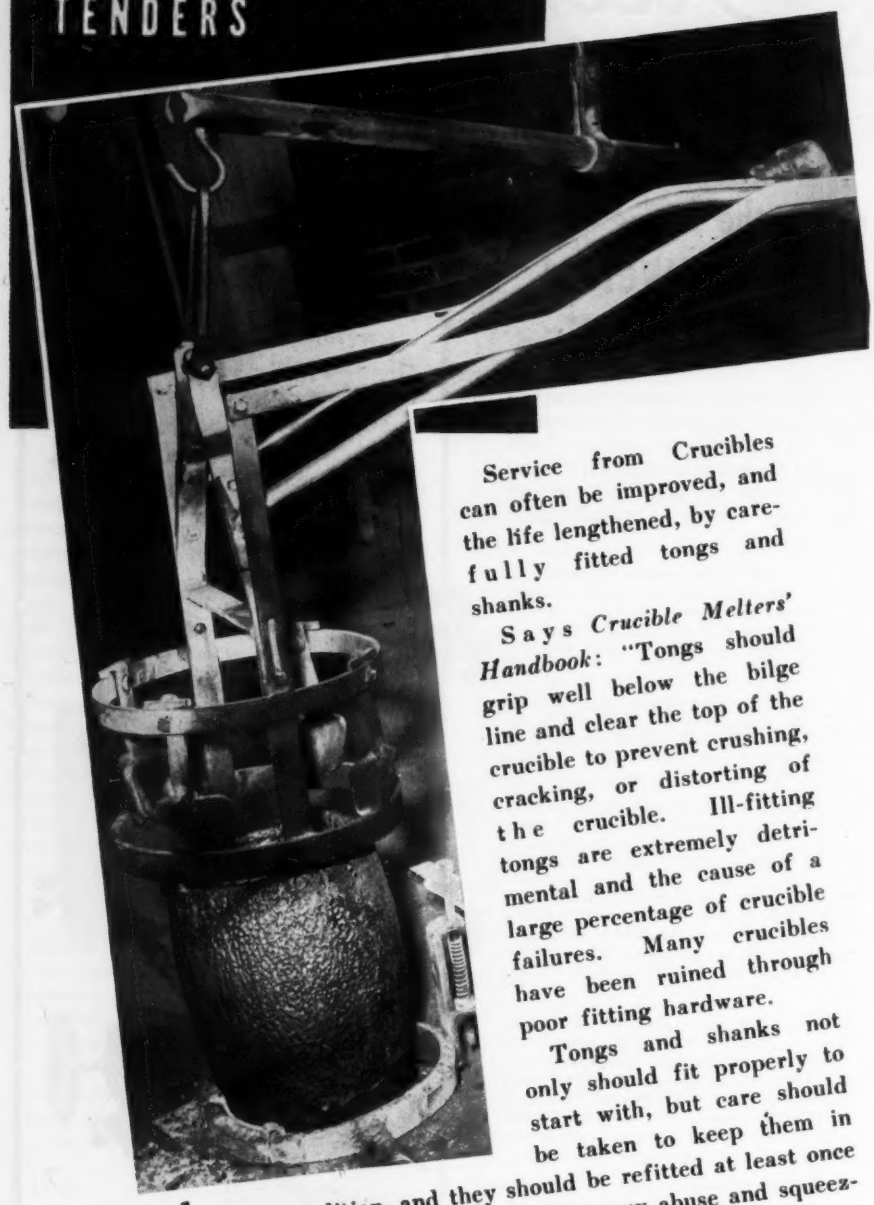
A PARTNERSHIP

METALLURGICAL APPARATUS

165 WEST WACKER DRIVE, CHICAGO 1, ILLINOIS

A MESSAGE TO CRUCIBLE FURNACE TENDERS

Special Self-Adjusting Basket-type Crucible Tongs (Patent pending) Photograph courtesy Hutchinson Foundry Products, Edwardsville, Ill.

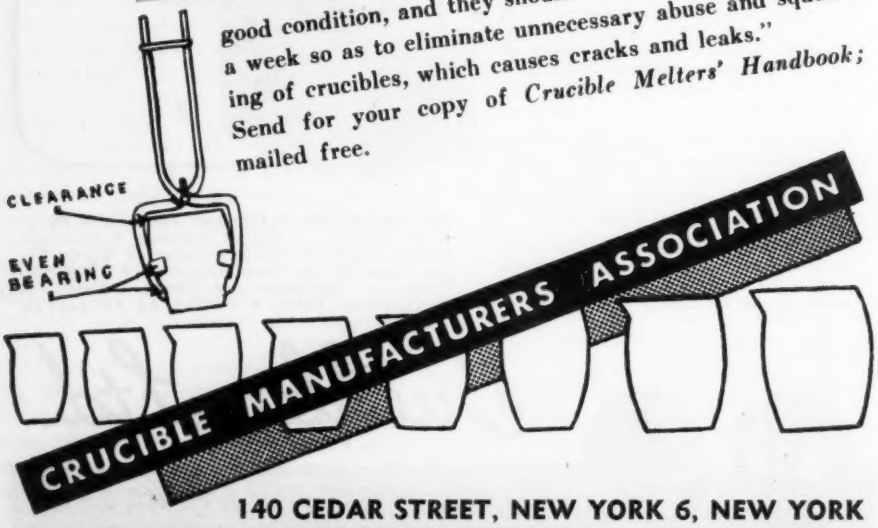


Service from Crucibles can often be improved, and the life lengthened, by carefully fitted tongs and shanks.

Says *Crucible Melters' Handbook*: "Tongs should grip well below the bilge line and clear the top of the crucible to prevent crushing, cracking, or distorting of the crucible. Ill-fitting tongs are extremely detrimental and the cause of a large percentage of crucible failures. Many crucibles have been ruined through poor fitting hardware.

Tongs and shanks not only should fit properly to start with, but care should be taken to keep them in good condition, and they should be refitted at least once a week so as to eliminate unnecessary abuse and squeezing of crucibles, which causes cracks and leaks."

Send for your copy of *Crucible Melters' Handbook*; mailed free.



140 CEDAR STREET, NEW YORK 6, NEW YORK

CHAPTER ACTIVITIES

(*Continued from Page 77*)

Schuler hotel, Grand Haven, Mich.

L. L. Clarke, assistant foundry metallurgist, Buick Motor Co., discussed "Cupola Practice," in which he emphasized the increasing demand for more control. Mr. Clarke's presentation culminated in a lively discussion period.

Central Michigan

C. C. Sigerfoos
Michigan State College
Chapter Vice-Chairman

CASTING DEFECTS and their remedies was the featured technical speech of the May 28 meeting, held at the Hotel Schuler, Marshall. The speaker, Harry W. Dietert of the Harry W. Dietert Co., Detroit, was introduced by George Bascom of the Albion Malleable Iron Co.

Prior to Mr. Dietert's address, Picnic Chairman Jack Secor, Hill & Griffith Co., announced that the Chapter's summer outing will be held at Cascades Park in Jackson August 21.

Nominating Committee Chairman A. E. Rhoads, Engineering Casting Co., presented the following slate of officers for next year: *Chairman*, C. C. Sigerfoos, Michigan State College; *vice-chairman*, F. Coghlin, Jr., Albion Malleable Iron Co.; and *secretary-treasurer*, George Petredean, Albion Malleable Iron Co.

In discussing the general topic of casting defects and their remedies, Mr. Dietert first covered the common casting defects caused by loose sand in the mold, and metal penetration. In connection with penetration, he pointed out that the common causes of this defect are soft ramming, pouring too hot, or using a sand having too high a permeability or a sand low in flowability.

Mr. Dietert then gave a detailed description of the causes of rat-tail casting defects, as brought out by the A.F.S. Committee on Physical Properties of Iron Foundry Molding Materials at Elevated Temperatures in its 1948 report, *"Causes of Rat-Tail Casting Defect."*

As chairman of the Committee, Mr. Dietert was in a position to give a very complete description of these studies. He pointed out that the Committee found that a molding

(*Continued on Page 87*)

CHAPTER ACTIVITIES

(Continued from Page 84)

sand having a combination of a high flowability, high hot strength, and high expansion will tend to produce rat-tails in a casting.

Remedies for rat-tailing include the use of a proper amount of combustible binder, softer ramming, reduction of hot strength, and reduction of expansion properties of the sand.

In conclusion, Mr. Dietert presented a motion picture that he had taken in his laboratory. The film depicted the difference in casting surface conditions effected by the mold atmosphere when the atmosphere is changed by forcing gas into a mold during the pouring, or by adding chemical compounds to the molding sand.

Tri-State

R. W. Trimble
Bethlehem Supply Co.
Tulsa, Okla.

THE LAST REGULAR MEETING of the year was held at Michaeles Cafeteria, Tulsa, May 21, and had as its speaker Nathan Janco of Centrifugal Casting Machine Co., who spoke on "Centrifugal Casting."

Results of the chapter election were confirmed and the Chapter's Annual Stag Party was tentatively scheduled to take place sometime in June, at a date to be announced.

Southern California

Leo N. Wood
Triplett & Barton, Inc.
Publicity Chairman

CUPOLA PRACTICE, an address by Dr. James T. MacKenzie, technical director of the American Cast Iron Pipe Co., Birmingham, Ala., was the featured address of the May 26 meeting.

Dr. Mackenzie discussed cupola operation and construction down through the centuries. His principal conclusions might be summed up in the statement that foundrymen should know how cupolas are made and the "whys" and "wherefores" of design if they are to get the most out of them.

Nomination for Chapter officers and directors for 1948-49 were announced. Candidates will be seated in June.

Chapter President H. E. Russill, Eld Metal Co., Ltd., Los Angeles, announced formation of "smog" committees in the various foundry

draw the mold

FAST AND ACCURATELY

• For smooth, accurate draw . . . for fast handling of cope and drag . . . use a B&P Champion Speed-Draw. Speed-Draws maintain positive pattern height resulting in perfect joint and uniform castings. Levelling of the machine is not required, power is applied to the center of the load and not through the crank mechanism. Pattern mounting is simplified and low in cost, and pattern changes can be made quickly and easily with a minimum interruption of production. Speed-Draws are often used with various types of Sandslingers and the combination assures peak capacity for both machines.

B&P Champions assure fast handling of each half of the mold—providing continuous Sandslinger ramming.

Two B&P Champion Speed-Draw Air Operated Machines used with a Tractor Type Sandslinger.

B & P CHAMPION SPEED-DRAW

• 11 Models, both Stationary and Portable to cover maximum range of mold sizes.

• Each model quickly adjustable for maximum variation of mold size.

• Minimum overall height for maximum draw obtained.

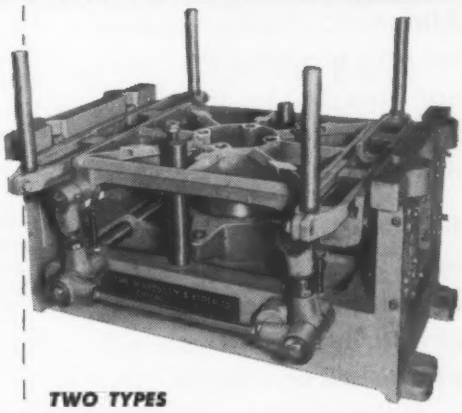
• No time consumed in rolling over.

• Crank mechanism is positive equalizer.

• Low maintenance cost.

• Time tested—used in many foundries—large and small.

WRITE FOR NEW SPEED-DRAW CATALOG!



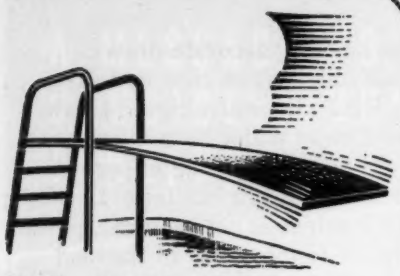
TWO TYPES

1. B&P Champion Speed-Draw Air Operated: Stationary Model—can be towed on skids (illustrated above). Portable Model on wheels.

2. B&P Champion Speed-Draw Jr. Air or Hand Operated.

BEARDSLEY & PIPER
Division of Pettibone Mulliken Corporation
2424 North Cicero Ave. Chicago 39, Illinois

B&P Champion Speed-Draws are a product of Beardsley & Piper, manufacturers of the Sandslinger • Speedslinger • Speedmuller • Screenarator • Mulbaro • Sand Conditioning Machine • Plate Feeder • Turntable



Molybdenum for "resilience"

The outstanding contribution of Molybdenum additions to the properties of cast iron is the notable combined increase in strength and toughness. An accepted measure of toughness is that area under a transverse strength-deflection curve (often called "resilience").

Resistance to impact is a feature of great interest to the engineering designer; this much-sought quality is within the power of every gray iron foundry to impart to cast iron merely by ladle additions.

A typical test shows that the addition of 0.35% Mo to a good base iron increased the resilience from 340 in. lb. to 575 in. lb., an increase of 69% in this important property.

This is one of the well-authenticated facts concerning the properties of Molybdenum cast iron, details of which will be furnished on request.

Authoritative engineering data on Molybdenum cast iron and its applications are furnished by Climax Molybdenum Company.

Climax Molybdenum Company
500 Fifth Avenue · New York City

MOLY

F2.

divisions. Smog eradication, ordered under State law, is a major problem to foundrymen in the area. Earle W. Grover, Apex Steel Corp., heads the Gray Iron Committee; A. L. Goodreau, G-B Brass and Aluminum Co., the Non-Ferrous Committee; and C. B. Tibbetts, Los Angeles Steel Casting Co., the Steel Foundries Committee.

Central Illinois

V. W. Swango
Caterpillar Tractor Co.
Chapter Reporter

MALLEABLE FOUNDRY PRACTICES were described in a talk by J. A. Durr of the Albion Malleable Iron Co., Albion, Mich., given before the May 17 dinner meeting of the Chapter at the Hotel Jefferson.

Mr. Durr stressed the importance of controls by the use of standards. The main phases of foundry work, such as melting, molding, gates and risers, sand, annealing and cleaning can all be set up under one standards department, Mr. Durr said, but this necessitates constant checking and testing as far as the sand and the melting is concerned.

The amount of jolting and squeezing of different kinds of molds comes under the standards department, which in some cases increases production considerably by eliminating unnecessary jolting and squeezing. The gating and risering standards not only increase yield but help in pattern layout.

Mr. Durr pointed out a means of combatting shortages of coal, coke and pig iron with hot blast methods of melting that utilize the hot gases that ordinarily escape out of the stack. Slides illustrated the talk.

Plans were announced for the Second Annual Clambake.

Cincinnati District

C. H. Fredricks
Cincinnati Milling Machine Co.
Chapter Reporter

REFRACTORIES was the subject of an address by H. F. Dunn, district sales manager of the Harbison-Walker Co.'s Portsmouth Division, delivered before the May meeting of the Chapter at the Engineering Society Headquarters, and attended by 74 members.

Mr. Dunn traced the development of the refractory industry from early methods of hand-ramming bricks to the modern method combining extrusion and pressing for all sizes of brick.

Using slides depicting the development of kilns from the old beehive style to the new continuous type, Mr. Dunn included a graph showing the effect of varying silica and alumina in refractories. The graph showed that the refractoriness of fire brick decreased as the alumina content increased, until the eutectic was reached—94.5 per cent silica and 4.5 per cent alumina—after which the refractoriness of the fire brick increased.

Mr. Dunn concluded his lecture by stating that his company has plants in various sections of the country but the brick produced in any one of these plants does not necessarily satisfy all the company's customers in a certain locality. Each customer, he said, finds that a certain one of the plants produces fire brick of a type that gives him better service than that produced by any of the others. This is due, he concluded, to the differences in cupola practices and types of charges used in different foundries.

Oregon

W. R. Pindell
Northwest Foundry & Furnace Works, Inc.
Chapter Director

ROTOBLASTING AT FORD'S, a film presented by the Pangborn Co. and showing the production of motor blocks at the River Rouge plant, was shown at the Chapter's April meeting, held at the Heathman hotel, Portland, prior to the evening's technical session.

Harry R. Dahlberg, assistant professor of industrial arts, introduced a group of Oregon State College students, members of the newly-formed student Chapter.

The technical program consisted of a panel of local foundrymen and engineers, who presented short papers on various subjects, followed by question and answer periods.

The first speaker was R. C. August, chief metallurgist of the Oregon Brass Works, Portland, who spoke on "Heat Treating of Aluminum Castings." Mr. August stressed the importance of complete and accurate control of alloy composition and oven temperatures necessary to hold the increased tensile strengths attained through treatment. Using slides, the speaker illustrated the effects of improper control in the foundry.

The second speaker, Professor Dahlberg, had as his subject "Coke

(Continued on Page 90)

USE

RELIABLE FOUNDRY REFRACTORIES

CUPOLA BLOCKS
TAP HOLE BRICK
BREAST BRICK
LADLE SKIMMERS
LADLE LININGS
LADLE SOLID BOTTOMS
LADLE SPOUT BRICK
BRASS FURNACE SHAPES
PLASTIC REFRACTORIES
FOUNDRY CLAY
STANDARD 9 INCH
SPLITS AND SERIES

The Pyro Refractories Co.

Oak Hill, Ohio

Cast Metals Handbook

List Price $6; $4 to A.F.S. Members . . .

Order a Copy Today

The Accepted Standard Reference Book for All CAST METALS

The complete, accurate and up-to-date reference book on the Engineering Properties of ALL Cast Metals should be among the technical books in every Foundry. Outstanding metallurgists and competent men of industry contributed to it. Committees of technical men helped compile it, from the engineering standpoint.

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CHAPTER ACTIVITIES

(Continued from Page 88)

in Gray Iron Melting." He pointed out that there are no standards available for coke, and discussed the physical, thermal and combustion characteristics of foundry coke. Professor Dahlberg's remarks were received with considerable interest because of the many problems which have lately arisen due to coke irregularities.

H. L. Tatham, Pacific Steel Foundry Co., Portland, described the production facilities of his company's highly-mechanized steel foundry. Mr. Tatham emphasized the need for various foundries in the Portland area to adapt their facilities to small-run jobbing work, and described Pacific Steel's methods along this line.

Edward Prehn of William Prehn & Sons Co., concluded the meeting with an address on "The Relationship of the Pattern Shop to the Foundry." Mr. Prehn stressed the savings to be effected by proper pattern design, by close cooperation between the pattern shop and the foundry, and by complete familiarity of the patternmakers with foundry practice. The subject of pattern finishes was discussed and the consensus was that present pattern finishes could and should be improved.

Rochester

G. M. Etherington
Gleason Works
Chapter Reporter

NOMINATIONS FOR officers and directors of the Rochester Chapter for 1948-49 are as follows:

President, Max T. Ganzauge, General Railway Signal Co.; *vice president,* Herman Hetzler, Hetzler Foundries, Inc.; *secretary-treasurer,* Leon C. Kimpal, Rochester Gas & Electric Corp.

Director (term expires 1949): L. C. Gleason, Gleason Works.

Directors (terms expire 1951): Fred Gehron, American Brake Shoe Co.; Kenneth Proud, Anstice Co., Inc., and William Richter of the Gleason Works.

Quad City

C. R. Marthens
Marthens Co.
Secretary-Treasurer

NATIONAL OFFICERS' NIGHT and the annual election of Chapter of-

(Continued on Page 92)

FIRM FACTS

Whiting Corp., Harvey, Ill., announces that it has acquired the business and plant of **Spencer & Morris, Inc.,** Los Angeles manufacturers of tramrail-type materials handling systems. The plant will be operated as the Spencer-Morris Division of the Whiting Corp., and will manufacture and distribute tramrail systems on a national scale through local distributors.

A company-wide scrap drive throughout the 60 plants of **American Brake Shoe** has netted more than four million lbs of usable scrap metal. The collected scrap was in addition to regular scrap produced in normal operations at Brake Shoe.

Organization of its own export department for distribution of its materials handling units on four continents is announced by the **Automatic Transportation Co.,** Chicago, and plans for the establishment of factories in Europe and the Orient are underway.

Barney I. Florey, Northeast Ohio representative for the Automatic Transportation Co., has removed his office and showroom to 3782 Ridge Road, Cleveland.

American Radiator and Standard Sanitary Corp. recently dissolved its subsidiary, **Tonawanda (N.Y.) Iron Corp.,** which will henceforth be known as the **Tonawanda Iron Division.**

Pacific States Steel Corp., Niles, Calif., recently signed a one-year lease with option for renewal for the Pittsburgh, Calif., foundry operated by the Columbia Steel Co. during the war. The **American Forge Co.** is moving its plant from Berkeley, Calif., and is erecting the largest and most modern forging plant west of the Mississippi in the vicinity of the Pacific States plant. Both companies are headed by Joseph Eastwood, Jr.

American Foundry Co., Indianapolis, planning to build a new Indianapolis plant to employ some 1500 men, estimates the cost at about $3 million.

The **Acheson Foundry & Machine Works'** real estate, buildings, and equipment, located in Highland Park near Chattanooga, Tenn., were recently purchased for $88,000 by E. N. Harrison of Knoxville. The newly-organized **Harrison Foundry Co.** will operate a general foundry, machine shop, and pattern shop. Acheson is continuing to operate its Alton Park plant, which was also included in the purchase, until a final decision is reached on disposition of the property.

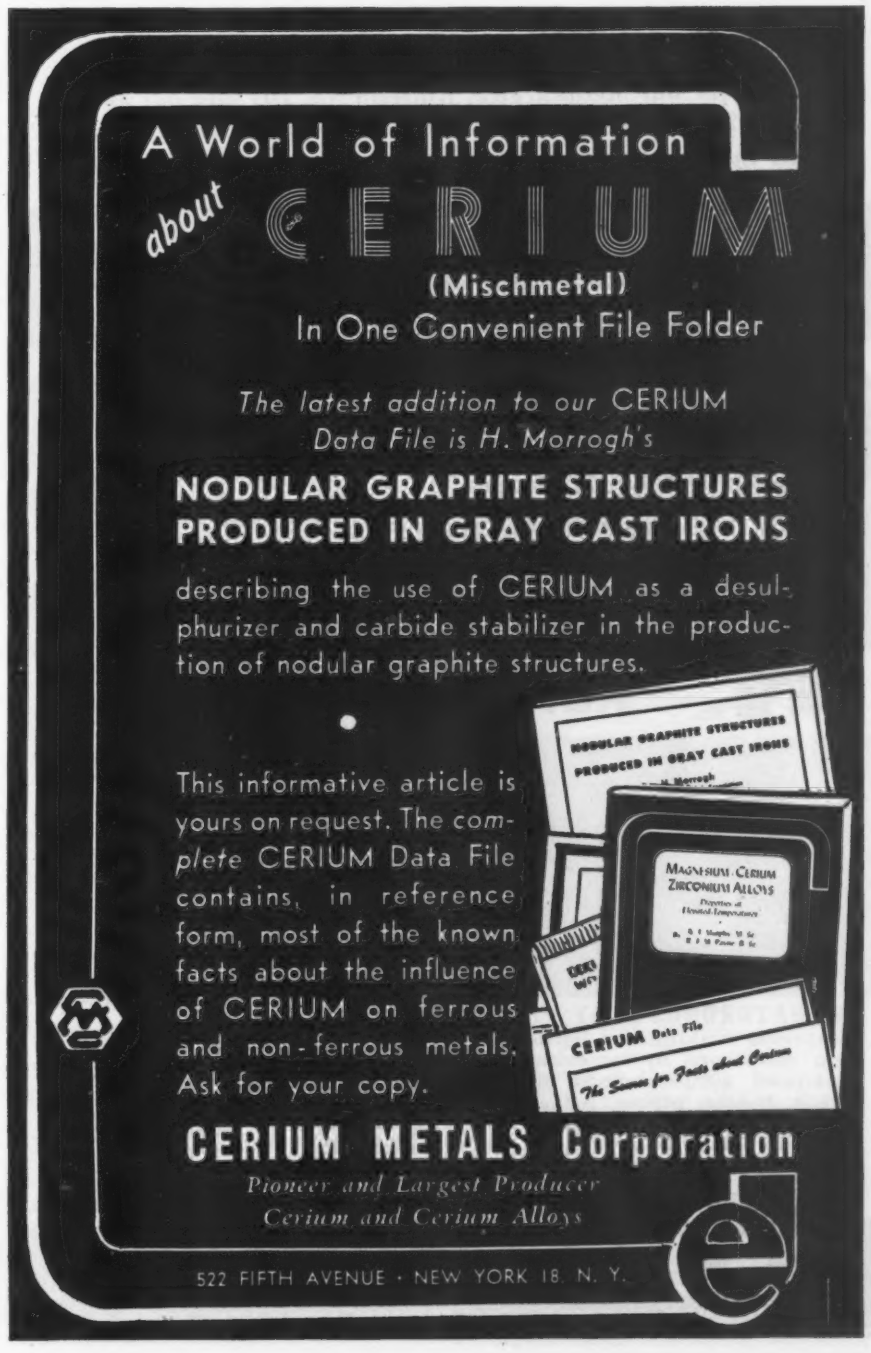
Fox Foundry, Inc., a consolidation of the **Granite City (Minn.) Pattern Works** and the **Fox Aluminum Co.,** was recently incorporated and will operate on the Fox Aluminum Co. site at St. Cloud, Minn., after the Pattern Works' equipment is moved in. Officials of the corporation plan to continue with the work formerly done in both plants. Officers of the new corporation are: Melvin Bump, president and manager; William Fox, vice president; Garold Linnell, secretary-treasurer; and Charles Bump, foundry manager.

Hahn Equipment Corp., formerly Hahn Engineering Co., has merged with **Pitz Foundry, Inc.,** Brooklyn, N.Y., under the corporate name of **Hahn-Pitz Corp.,** and will be located at the plant—286 Scholes St., Brooklyn 6. Robert G. Pitz was elected president and Eugene Hahn, vice president and general manager. Products will continue to be pipe line and pneumatic conveyors, cast iron sectional tanks, bunkers and hoppers, and mechanical soot blowers.

Federated Metals Division of American Smelting & Refining Co. has moved its New England office to new and improved quarters in the Statler Office Bldg., 20 Providence St., Boston 16, Mass. Telephone numbers will remain unchanged.

The **Gilfillan Foundry & Machine Corp.,** Buffalo, N.Y., closed for several years and reopened less than two years ago by W. A. Miller and C. B. Williams has been built into a substantial business enterprise during that period and is now planning the purchase of new machinery and enlargement of its plant facilities sometime this fall, it is announced.

Atlas Pattern Works and Atlas Plastic Works, Milwaukee, have been merged into one company, to be known as the **Atlas Plastic & Aluminum Pressure Plate Co.,** according to an announcement by Steve Denkinger, Jr., president.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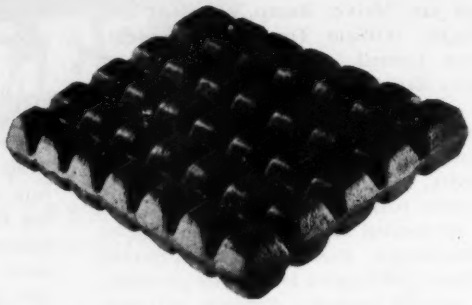

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CHAPTER ACTIVITIES

(*Continued from Page 90*)

ficers was held May 17 at the Fort Armstrong hotel, Rock Island, Ill.; 130 members attended.

National President Max Kuniansky spoke on "Operation of a Production Foundry." He was introduced by National Past President H. Bornstein, Deere and Co.

At a luncheon given at the Davenport Club the day of the meeting, President Kuniansky addressed a group of top management executives from foundries in the area, in which he stressed the development and training of supervisory foundry personnel and illustrated the ways in which his company delegated authority to various branches of foundry operations.

At the evening business meeting, Chapter Chairman R. H. Swartz announced the results of the election of officers for 1948.

Ontario

A. E. Bock
Standard Castings & Mfg. Co.
Publicity Chairman

THE ANNUAL CLOSING PARTY OF the Chapter for the 1947-48 season was held at Toronto, May 14. A social hour preceded the business meeting and dinner.

Chapter Chairman James Dalby presided at the dinner and at its conclusion turned the meeting over to R. A. Woods, Geo. F. Pettinos Co. (Canada), Hamilton, Ont., who announced the new roster of Chapter officers and directors.

J. A. King of the Werner G. Smith Co., Toronto, Ont., incoming vice-chairman and retiring chairman of the entertainment committee, presented a floor show made up of professional entertainers, concluding the Closing Party.

Central New York

John A. Feola
Crouse-Hinds Co.
Publicity Chairman

MECHANIZATION for small foundries was the principal address of the May 14 dinner meeting of the Chapter at the Onondaga hotel, Syracuse.

The speaker, Norman Smith of the Link Belt Co., Philadelphia, opened his address by saying that if the foundry is to be "a GOOD place to work," heavy manual labor must be eliminated in order to attract the young men of today.

Many operators of small foundries do not think of mechanization because of the belief that large sums of money are involved, but, Mr. Smith said, installations have been made in foundries employing as few as six molders, and have proved economical both to install and operate. These small setups are beneficial to employees and owners alike, he added.

Mr. Smith proved his statements with a series of slide pictures that showed more efficient operation with less heavy labor in fully or partially mechanized foundries employing from 6 to 16 molders.

Chapter Chairman R. A. Minnear, Ingersoll-Rand Co., presided at the business meeting following Mr. Smith's talk and announced that the Chapter would be guests of the Shepard Niles Crane & Hoist Co., Montour Falls, for the annual business meeting and election of officers on June 16.

At the technical session,, under the direction of James Ochsner of the Crouse-Hinds Co., it was announced that the Chapter had obtained an additional speaker for the evening, Dr. Ludwig Wilhelm von Brimbach, who was introduced with an elaborate history of his achievements in German industry and as a lecturer in universities.

The audience, very much impressed, listened attentively to the Doctor's description of the regimentation of foundries and the methods used to overcome materials shortages in World War II.

As von Brimbach proceeded, his listeners began to suspect that he was burlesquing the foundry materials problem everyone is facing in this country today. The audience was greatly surprised to learn, at the end of the talk, that the supposed Dr. von Brimbach was impersonated by Henry Bach of Crouse-Hinds Co.

Central Indiana

J. W. Giddens
International Harvester Co.
Chapter Secretary

WILLIAM B. MCFERRIN, metallurgical engineer, Electro-Metallurgical Co.,, Detroit, addressed the April meeting at the Athenaeum, Indianapolis, on "Gray Iron Casting Defects." More than 130 members and guests heard the talk, illustrated with lantern slides.

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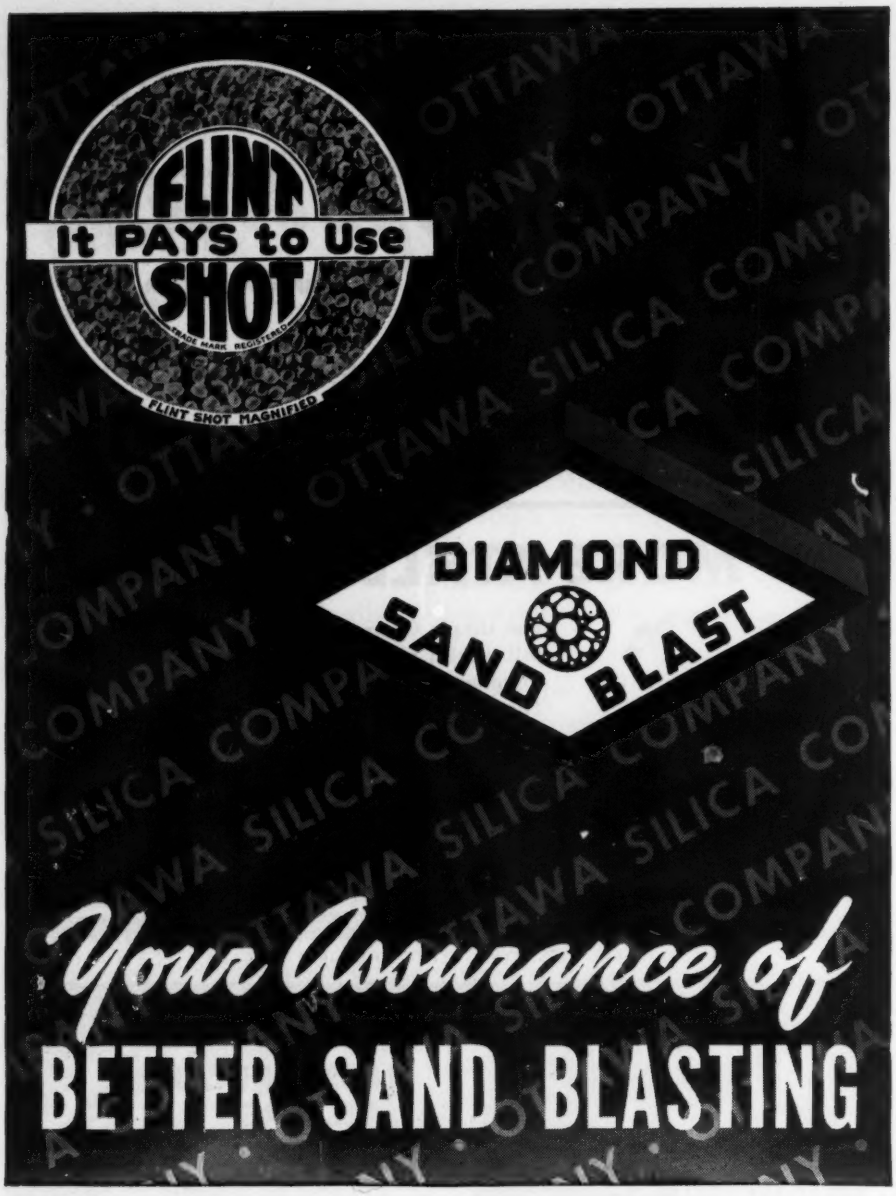

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officers, to be held at this month's meeting were announced by Ray Fickenworth, C & G Foundry & Pattern Works, nominating committee chairman.

Frank Smith, assistant superintendent, American Foundry Co., served as technical chairman for the meeting, which was preceded by a dinner. Paul V. Faulk, chapter treasurer, presided in the absence of Chairman W. B. Ziegelmueller.

Rochester

G. M. Etherington
Gleason Works
Chapter Reporter

TRIBUTE NIGHT, held May 11 at the Hotel Seneca, honored David Baxter of the Sterling Wheelbarrow Co. for his half-century of service to the foundry industry. Tall stories of the veteran foundryman's career were a feature of the evening, and several gifts were presented him.

Officers and directors for the coming year were announced at the Annual Business Meeting.

Guest technical speaker for the evening was Michael Bock of Exomet, Inc., who spoke on "Shrinkage Problems." Mr. Bock stated that x-ray examination shows analysis and gating and risering systems are largely responsible for shrinkage and porosity in castings The use of exothermic materials as a riser addition and the use of insulating pads in overcoming these problems was discussed.

Tri-State

F. E. Fogg
Acme Foundry & Machine Co.
Publicity Chairman

1948-49 OFFICERS AND DIRECTORS nominated by the Tri-State Chapter are as follows:

Chairman, Dale Hall, Oklahoma Steel Castings Co.; *vice chairman,* C. A. McNamara, Jr., Big Four Foundry Co., Inc.; *secretary,* D. A. Mitchell, Progressive Brass Mfg. Co.; *treasurer,* R. H. Timberlake, Metal Goods Corp.

Directors (terms expire 1949): Fred E. Fogg, Acme Foundry & Machine Co.; and Morris C. Helander, Empire Pattern & Foundry Co.

Directors (terms expire 1950): B. P. Glover, M. A. Bell Co.; and Frank R. Westwood, Jr., Service Foundry Co.

Directors (terms expire 1951): C. C. Beagle, The Webb Corp.; J. E. Winger, Tulsa Iron Works Co.

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NEW LITERATURE

(*Continued from Page 80*)

used in insulating the positive plate. The second pamphlet describes the Gould "Kathanode" battery and includes engineering specifications for the various capacities and types of this battery.

AU116—Arcos Corp. has available a complete technical data sheet on the 11 analyses of alloy electrodes for use in fabrication welding and salvage of both high and low alloy castings. Both corrosion resisting and heat resisting types are included, together with ACI casting designations by type and recommended electrodes for use with each. Also tabulated are tensile properties and weld metal composition of Arcos lime and titania types, and hydrogen-controlled electrodes.

Foundry Films

AU117—A series of seven sound motion pictures and six silent filmstrips, designed to act as corollary teaching aids in college classes using French's Engineering Drawing, has been prepared by McGraw-Hill Book Co., Inc. These new visual aids will help the student to visualize those principles of engineering drawing which have proven the greatest stumbling blocks, according to instructors. Text-Films cover the theories of orthographic and auxiliary projection, sectioning and dimensioning. Two special orientation films are designed to help create a favorable attitude toward the subject in the minds of the students, and to acquaint them with actual procedures from blueprint to finished product. A new technique, combining the use of special models photographed in conjunction with animated drawings of lines and planes, permits the projection of views before students' eyes, as well as cutting away entire sections of models to reveal interior views. Film titles are: (1) *According to Plans: Introduction to Engineering Drawing* (2) *Orthographic Projection* (3) *Auxiliary Views: Single Auxiliaries* (4) *Auxiliary Views: Double Auxiliaries* (5) *Sections and Conventions* (6) *The Drawings and the Shop* (7) *Selections of Dimensions.*

AU118—*Curiosity Shop,* a technicolor motion picture produced by Wilding Picture Productions, Inc., for the Aluminum Company of America, features Hollywood stars John Litel and June Lockhart in a story of the scientists who struggled to make aluminum more useful. The "curiosity shops" referred to are the laboratories and workshops of such men as Thomas Edison and Charles Hall. The film is designed as a companion piece to *Unfinished Rainbows,* Alcoa's first documentary picture, dealing with the life of Charles Hall. *Curiosity Shop* continues the "human biography of aluminum" theme by interweaving the story of a young college student's romance with a factual account of the development of new uses for aluminum. Prints of this film are available in 16mm and 35mm for school, church and club showings on request.

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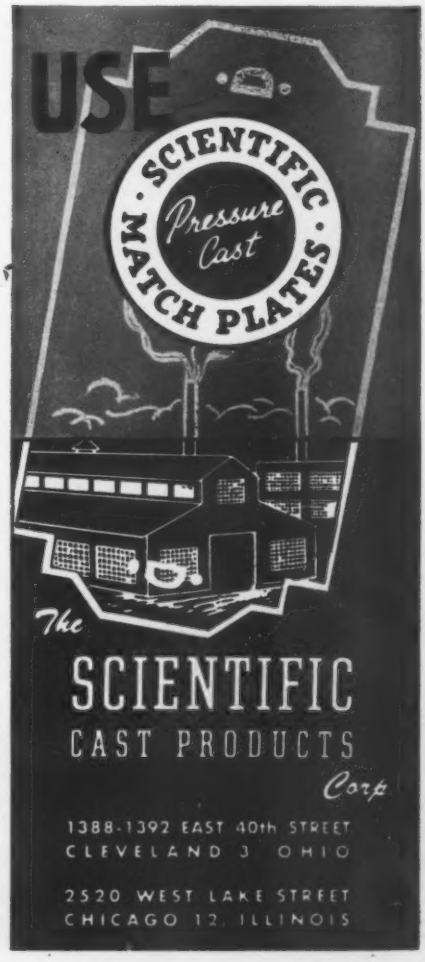

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